THE INFLUENCE OF SELECTIVE ATTENTION ON THE PERFORMANCE OF LEARNING DISABLED STUDENTS

BY

DANIEL WALKER BECTON

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Attention has been compared to the beam of a searchlight moving about in the dark. It may focus on the world without or on inner thoughts and fancies. But the act of paying attention is much more than the focusing of a searchlight. It selects and draws into the foreground, while initiating neuronal action on the stage of consciousness. Other action may go on off stage. Off-stage action is not arrested, but it is ignored — only what happens on stage is recorded and remembered.

Wilber Penfield, 1969, p. 164-5

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Daniel Walker Becton

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The purpose of this study was to investigate the importance of visual selective attention to learning disabled (LD) students' reading performance. Another objective was to examine how this was influenced by modality preference. The final goal was to investigate the reliability and validity of the measurement instrument, Hagen's Central Incidental Attention Task.

Section One compared a sample of LD students in the Systematic Instructional Management Strategies (SIMS) precision taught reading program (N = 19) to LD students in a multisensory program (N = 20). Selective attention was significantly related to the dependent variable, reading recognition, but the reading group and the interaction were also significantly related to reading. Consequently, this result was possibly due to differences existing between the subjects in the reading groups prior to the study.

Section Two used a different, larger sample of LD students from the SIMS program group (N = 67). No significant relationship between selective attention and reading was found. Modality preference was significantly related to reading achievement only when analyzed with selective attention defined as group levels. Modality preference was not significantly related to selective attention scores. Students with low performance in visual modality subtests had decreasing selective attention scores paired with increasing intelligence (IQ) scores, suggesting that modality preference was learned. However, the interaction was not significant.

Section Three used LD students (N = 16) from the multisensory group to study the selective attention task. The results showed low correlations with other measures of selective attention. A meta-attention task showed correlations between selective attention and the rating of "interest" as an important condition for attention. Age and achievement performance correlated positively with rating "reward" and negatively with rating "quiet" as important conditions. The instrument did correlate significantly with teacher ratings of some classroom attending behaviors.

In summary, the relationship found between selective attention performance and reading achievement was not significant. Combining central and incidental scores (C + I) for selective attention did produce the closest relationships. Modality preference seemed to be a learned adaptation, not significantly related to selective attention.

CHAPTER I

INTRODUCTION

The purpose of this study was to investigate the importance of visual selective attention to learning disabled students' reading performance. This study also examined how this relationship was influenced by the students' modality preferences.

Rationale for the Study

Behaviors related to deficits in attention have often been cited as a common characteristic of children with learning disabilities (LD). Furthermore, many research studies and theories have asserted the importance of studying attention for a better understanding of learning disabilities.

Within the medical literature on learning disabilities, Silver (Note 1) describes minimal brain dysfunction (MBD) children as distractible with short attention spans. He even refers to a subgroup of "attentional deficit" children. Within psychological practice, the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 1980) details the Attention Deficit Disorder which is sometimes used in diagnosing children who have learning disabilities. In special education, Mercer's (1979) basic textbook on learning disabilities presents the cognitive process interpretation, which focuses

on attention and memory, as one of three major contexts for interpreting the psychological processes involved in learning disabilities.

Researchers studying learning disabled children have documented LD students' attentional difficulties. Conners, Kramer, and Guerra (1969), Grassi (1970), Lasky and Tobin (1973), and Swanson (1980) have investigated the auditory attentional difficulties. Anderson, Halcomb, and Doyle (1973), Atkinson and Seunath (1973), Hallahan, Kauffman and Ball (1974), Mercer (1975), and Swanson (1980) have documented the attentional deficits in the visual domain. There is evidence that this extends to inattentiveness in the classroom (Bryan & Wheeler, 1972) and influences visual selective attention strategies in reading (Schworm, 1982). Torgesen (1977) has studied how these problems in selectively attending lead to general deficiencies in problem solving strategies. Samuels and Edwall (1981) asserted that "attention emerges as one likely candidate for intensive investigation in the search for the etiology of learning disability" (p. 353). Ross (1976) recommended that the definition of a learning disability should include the inability to sustain selective attention.

In the literature, no studies were found which examined the relationship of selective attention to the reading performance of LD students while in a precision teaching program. Hallahan (Note 2) also reported that this relationship has not been investigated. Investigation of the influence of selective attention on reading is designed to increase understanding of the implications of the selective attention literature for applications in classes for learning disabled students.

Specification of Terms

Learning disabled children. These were children identified as such by a public school system. The selective criteria included an intelligence test score not less than two standard deviations below the mean, academic achievement below "expectancy age" guidelines, and evidence of a psychological process disorder (see Appendix A).

Attention or selective attention. Selective attention refers to the ability to attend to relevant features of a stimulus array that also contains irrelevant proximal distractors. This was operationally defined as scores obtained on the Hagen Central Incidental Attention task (Mercer, 1975) as follows (see Appendix B):

1. The central task (C) was the one that the LD students received instructions about initially.
2. The incidental task (I) was the later, unexpected matching task.
3. The selective attention efficiency index (%C - %I) was the percent of the central task correctly completed minus the percent of the incidental task correctly completed (Tarver, Hallahan, Kauffman, & Ball, 1976).
4. The combined selective attention measure (C + I) was simply the sum of both measures, reflecting all of the interaction, distraction, and capacity.
5. The selective attention levels were defined by combining overall capacity (C + I) with efficiency (%C - %I) or incidental task scores (I).

Reading achievement. This was defined by reading test scores on either the Wide Range Achievement Test (WRAT) (Jastak & Jastak, 1978), or the Peabody Individual Achievement Test (PIAT) (Dunn & Markwardt, 1970).

Modality preference. This was defined by performance on the Detroit Tests of Learning Aptitude (Baker & Leland, 1967). Three groups were identified. They were LD students with only low visual subtests, LD students with only low auditory subtests, and LD students with a mixed preference, i.e. any other combination.

Attending behavior. This was defined by a series of questions about classroom behaviors that reflect attending (see Appendix C).

Meta-attention. The child's awareness or understanding of his/her own attentional processes, strategies, and capacity. This was tested using the instrument used by Loper, Hallahan, and Ianna (1982) (see Appendix D).

Statement of the Problem

The purpose of this study was to investigate the relation of visual selective attention to reading performance of learning disabled children. The question developed from the extensive literature asserting that learning disabled children are frequently characterized as exhibiting attention deficits and because of the literature showing precision teaching to be a technique effective for teaching reading to learning disabled children. The major question was: Do the selective attention processes of learning disabled children underlie or determine their reading performance in this program?

Significance of the Study

Because of the widespread and expanding use of precision teaching, defining the relationship between academic performance when using this technique and selective attention processes became important. The literature suggested selective attention as the critical characteristic that produced learning disabilities. This became an important applied research question because it applied directly to so many LD classrooms and training programs. This study focused on relating selective attention research more directly to current strategies, endorsed by many LD teachers, that were actually being used in LD classrooms. Continuing this concern for relevance or generalizability, this study used achievement and process measures currently widely used in LD programs.

Furthermore, a proliferation of research on Cognitive Behavior Modification (CBM) has cited the selective attention research for support. This study has some implications for the use of CBM to compensate for selective attention deficits because it provides achievement performance in a precision teaching intervention for comparison, identifying selective attention characteristics of the population. Thus new knowledge of how selective attention influences reading performance coupled with the other research on how it related to CBM should help provide for effective integration of the techniques in LD classrooms.

Research Questions

This study was designed to answer the following questions regarding the influence of selective attention on reading performance.

1. Did using the Systematic Instructional Management Strategies (SIMS) program favorably alter attending behavior so that LD students experiencing reading problems attributable to selective attention would be differentially helped compared to another method for teaching reading? Would the reading performance in this other reading method and in non-learning disabled students have been influenced by selective attention?
2. Was this relationship best characterized in LD students as due to a limited filtering or limited capacity process (%C - %I), where central performance limits incidental performance? Or was it best characterized as due to the total processing capacity with distraction (C + I)?
3. Without comparisons to other teaching methods, would grouping of LD students by level of selective attention performance show differential reading improvement?
4. Would the effect of selective attention on reading performance, after allowing for age differences, have been best explained by incidental performance limiting central performance as in the efficiency measure (%C - %I), or by the total capacity with distraction measure (C + I)?
5. Did low visual selective attention scores correspond to low visual modality aptitude? Could these results have been due to visual modality aptitude or a process underlying it?

6. Was selective attention in the LD group more closely related to underlying modality aptitudes or to general intellectual functioning?
7. Were the effects ascribed to selective attention possibly due to teacher differences?
8. Was this extensively used research instrument, Hagen's Central Incidental Attention Task, measuring the same underlying construct, selective attention, as other instruments and techniques? Did the incidental score really appear to increase at the expense of the central score?

The research study was organized around these questions in three sections. The first section used three small samples of subjects. They were students using the SIMS program, students using a traditional LD reading program, the Visual-Auditory-Kinesthetic-Tactile program (VAKT), and a sample of students referred but not admitted to the LD program using the regular basal reading program. This section investigated questions one and two. The second section used a sample of LD students in the SIMS program larger than many of the selective attention research samples and investigated questions three through seven. The final section used students from the first section but compared their performance on several other tests to their initial performance on the selective attention task in investigating question 8.

Limitations of the Study

Hagen's Central Incidental Attention Task has been restricted to research use and, because of the nature of incidental measures, its

use was only theoretically justified and supported. Validity and reliability information were not available and there was some debate about whether it clearly measured selective attention (Douglas & Peters, 1979).

This use of learning disabled students also placed restrictions on the generality of these findings. The generality was also bound by the limits of the instruments used for diagnosis and the public school LD criteria (see Appendix A).

The variability of LD students also limited generality. These research questions were based on other research using selective attention as a general characteristic of the group of students labeled learning disabled.

CHAPTER II

REVIEW OF THE LITERATURE

An extensive literature asserting that learning disabled children frequently exhibit attention deficits revealed the importance of this research study. In addition to those studies already mentioned in Chapter I which relate attention deficits to learning disabilities, this chapter focused on research with Hagen's Central Incidental Attention Task and similar instruments. Secondly, the importance of reading achievement in the Systematic Instructional Management Strategies (SIMS) program was established in this chapter by reporting the results of achievement data on major precision teaching projects. Finally, current research on the traditional learning disability concepts, modality preference and multi-sensory teaching, was presented. The result has been a clear rationale for the importance of investigating the interaction between a concept that was called the "origin" of a learning disability (LD), selective attention, and one of the most promising techniques for teaching LD students.

Selective Attention

Background

Selective attention refers to any method of information processing that allows the student to respond on the basis of a limited portion of the available stimulus information. Two types of models explained selective attention studies. One type, the filter theories, was developed

by Broadbent's (1958) research. These theories led to the development of Hagen's Central Incidental Attention Task. They postulated mechanisms that screen certain kinds of input at various stages of information processing. Thus attention capacity was limited and the filtering mechanism shut out irrelevant stimuli. The other type, the capacity theories, postulated that the system, based on goals, selected certain inputs and ignored others because of insufficient resources within the processing system. The greatest success of capacity theories was their ability to explain contradictory divided attention studies by ascribing different capacity requirements to the tasks being combined.

Samuels and Edwall (1981) did a comprehensive review of research on attention focusing on aspects such as arousal, alertness, capacity, and selectivity. In several studies it seemed poor readers and LD students had difficulty focusing attention on a narrow band demanded by the task, i.e., selectivity. The authors decided that vigilance did not tap the sustained aspect of attention corresponding to school tasks. Furthermore, they reported that such tasks did not differentiate LD students from normal students. Instead it differentiated hyperactive students from other students.

Keogh and Margolis (1976) also reviewed a large number of attention studies. However, they focused their review on the following three aspects of attention that they felt related to remediation: (1) coming to attention, (2) decision making, and (3) maintaining attention. They felt that such a differentiated approach to any deficit had more direct implications for remediation.

Harris (1976) reviewed the attention research, also focusing on educational attention control. But he felt that attention as studied related too closely to classroom behaving and that "the mechanisms of attention have no correlation with academic performance" (p. 55). He reported how techniques of drug therapy, reduced environmental stimulation, and operant conditioning of drug therapy, reduced environmental stimulation, and operant conditioning effectively produced behaviors operationally called attention. He also suggested verbal self-direction may be a future technique for improving attention behaviors. But generally he felt "attention training should not be expected to improve academic skills" (p. 108).

Koppell (1979) criticized the attentional deficit explanation of learning disabilities saying that research must examine the strength of the association between the extent of the learning disability and performance in the experimental paradigm. However, if the measure of the extent of a learning disability is defined by the academic performance, then this is the major goal of the research questions from Chapter I. Thus, unlike Harris' opinion, the relation between the extent of LD students' academic deficiencies and the students' deficits in selective attention seemed to be the critical measure of the importance or the usefulness of the hypothesis of selective attention deficits.

Several researchers have dealt with other deficits, such as maintaining attention, as characteristics of LD students. Anderson, Halcomb, and Doyle (1973) used a visual vigilance task successfully in significantly differentiating between LD students and normal students. A

higher error rate and longer response latency reflected vigilance attention deficits. In a further study, Doyle, Anderson, and Halcomb (1976) used this task with a visual distractor. While the LD subjects showed evidence of an attentional deficit, hyperactive LD students were more severe and much of the difference can be attributed to them. Swanson (1980) also found older nomoactive (CA = 12) LD children made significantly fewer correct detections and more false responses than did normal children on a vigilance task.

Ross (1976), in an extensive review of the literature, reported how studies of reading or learning disabled students led to his conclusion that "learning disabilities may thus be viewed as the result of delayed development in the capacity to employ and sustain selective attention" (p. 61). He showed that studies using measures like motor responses, heart-rate changes, changes in brain electrical potential, and auditory messages repeatedly show that selective attention capacity improved with age. He offered a theoretical model for selective attention development. The first stage was overexclusive (also overselective) attention. Aspects of a stimulus capture attention to the exclusion of other aspects in this stage which normally extended from infancy to preschool. The next stage was overinclusive attention. This corresponded to a period of maximum incidental learning, covering preschool and elementary schooling. Finally, the student developed selective attention, which influenced the decline in incidental learning seen around age 12.

Ross' (1976) explanation for learning disabilities suggested some possible problems in investigating the research questions from Chapter I. The LD selective attention problem was not permanent, but a delay causing the student to be in earlier, inappropriate stages during his reading education. Thus the academic deficit developed, continued, and hindered future learning, even after the selective attention capacity matured. Thus maturation over time weakened the relationships in research questions one to four. An analysis by age groups (hypothesis three) clarified this.

Ross (1976) also suggested that some results reporting a preference of auditory digits over visual digits may be a result of negative reactions to the visual stimuli from repeated reading failure. He thus suggested that such a modality based reaction may show a consequence rather than a cause of the students' reactions. He also implied that the modality dimension of stimuli may become less dominating of attention with maturation. This suggested that a narrowing or broadening of attention exaggerates, then reduces, LD students' modality preferences. This will be elaborated on later in this chapter.

Dykman, Ackerman, Clements, and Peters (1971) also offered a comprehensive review of research as evidence of a specific learning disability syndrome with the cardinal symptom of defective attention. They suggested that this was due to the interaction of the excitation from the brain-stem reticular formation and the forebrain inhibitory system, centering on the diencephalon. They used designations similar to Ross', but only hyperactive LD children were considered to be overattentive and hypoactive LD students were underattentive.

Schworm (1979, 1982) also reviewed the literature on LD attentional deficits, but with an emphasis on reading. In one study (Schworm, 1979) the treatment consisted of cues to get the student to direct attention to distinctive features and invariant word properties. He suggested that inadequate readers failed to develop the grapheme-phoneme correspondences because they did not attend selectively to important stimulus properties.

Schworm (1982) recently reported an impressive investigation very similar to the goals of this research study. He administered a test of selective attention, the Select-A-Figure-From-Many (SAFFM) test. He used the Spelling Pattern Tests which he had developed (Schworm, 1979). Finally, he used the Wide Range Achievement Test (Jastak & Jastak, 1978), which was also used in this study, as outlined in Chapter III.

Comparisons between the LD readers and the low, average, and high achieving readers from regular classrooms showed the LD readers required significantly more trials on both parts of the selective attention task. The letter pattern test results of the regular classroom readers correlated $r = .72$ with their SAFFM results. Significant correlations showed that both better achieving and older students completed both tests better than other students.

There were also significant differences between the LD students and other students on the two letter pattern and three letter pattern of the Spelling Pattern Test (Schworm, 1982). Finally, the debriefing of the selective attention task was analyzed for number of cues reported, types of cues reported, and degree of interaction recorded (help from

experimenter), using multiple regression analysis. They were good predictors of reading achievement (R^2 = .69), two letter spelling pattern identification (R^2 = .79), and three letter spelling pattern identification (R^2 = .69), as well as performance on both parts of the selective attention test A1 (R^2 = .70) and B1 (R^2 = .62). The present research study also investigated the relation of selective attention to reading, but used Hagen's Central Incidental Attention Task.

<u>The Central Incidental Task</u>

Tarver and Hallahan (1974) performed a literature review of 21 experimental studies. They noted how the hypoactive and hyperactive LD students differed in some studies. They also noted several ways that subjects with learning disabilities were different from other subjects. LD students were deficient in their ability to maintain attention for prolonged periods (vigilance). LD subjects were more impulsive, or less reflective. LD students' hyperactivity could be situational-specific. Finally, LD subjects exhibited more distractibility on tasks with embedded contexts, or tests of incidental versus central learning. Their own work with Hagen's Central Incidental Attention Task was a major part of that research.

Maccoby and Hagen (1965) used Broadbent's ideas (1958) about "focusing of attention" in studying individual responses to information in the stimulus complex that exceeds their processing limit. Theoretically the young child was handicapped in focusing attention selectively, lacking previously established discriminations between task-relevant and task-irrelevant aspects of the stimulus complex. They used a task

arrangement with background color matching as the central task and picture matching as the incidental task. They also had a "distractor" or subsidiary task. The subjects had to tap whenever a single bass note played on a tape of a piano melody of high notes. The results showed that central recall increases regularly with age. Distraction reduced efficiency on the central task as errors rose by 26%. However, incidental recall declined with age, and errors under distraction increased by 15%.

Hagen and Kail (1975) reviewed a series of studies involving central and incidental stimuli in the task, both auditory and visual. The major pattern was replicated, with central recall increasing with age while incidental recall did not change significantly until it declined in older subjects. Though different modifications were tried, no differences in central task performance occurred due to pairing conditions. Apparently, just the mere presence of incidental pictures was distracting, regardless of how they were modified. They suggested that older students used verbal labeling and other task-relevant strategies which younger students lacked. Several studies using different tasks supported this trend with incidental learning declining between ages 12 and 14 years. They also cited studies with retardates that showed that selective attention improved as the MA label increased. In Section Two, Chapter IV, of this dissertation, selective attention was compared to increasing IQ scores in LD students.

Using a questionnaire with this attention task, Druker and Hagen (1969) found that with increasing age there was a progressive rise in

the tendency to rehearse by saying only the task-relevant items. More of the older subjects indicated they tried to look at only the relevant item on the card. Another finding of this study with 80 normal subjects was that developmental changes monitored by the task did not involve improved visual discrimination.

In another study, Hagen (1967) used a vigilance distractor with the Central Incidental Attention Task. Distraction significantly affected task-relevant performance and did not affect incidental performance except at the oldest grade. He also had a control group using cards with only the central stimuli. The results indicated that the presence of a second picture had a deleterious effect at all age levels.

In a similar study, Hagen, Meacham, and Mesibov (1970) found that with college students (N = 40) there was no deleterious effect shown between one versus two stimuli. However, a verbal rehearsal condition, repeating the name of the animal, had a detrimental effect on the college students, primarily because of a primacy decrement. The verbal rehearsal condition had a favorable recency effect. This verbal labeling did not affect children (N = 96) ages 9 to 14. Hagen also reported an earlier study which found that verbal rehearsal improved performance of children from ages 6 to 8. A follow-up study (Hagen, Hargrave, & Ross, 1973) used children of ages 5 to 8 to induce the verbal rehearsing found with older children. However, in comparing a rehearsal alone to a rehearsal with prompting, recall only improved at the younger ages, and only with prompting.

Wagner (1974) reported a study in Yucatan, Mexico, using Hagen's Central Incidental Attention Task. They found the same developmental patterns as other studies in an urban sample, but a different pattern in a rural sample. The rural sample did not show a marked primacy effect. An additional study found that unschooled urban adults were like the rural sample and significantly different from schooled urban adults. The results suggested that formal education is a major factor in the ability to use verbal rehearsal or other attention and memory strategies as measured in this attention task.

In his review of studies of faulty attention in children, Hallahan (1975) dealt specifically with selective attention, attention span, hyperactivity, impulsivity, and with distractibility in general. The same central incidental task that Hagen developed was used in most of these studies. The ability of normal children to attend to central information and ignore incidental material increased with age until a major drop in incidental recall at twelve to thirteen years of age. With the groups equated by mental age, educable children performed below normals while those not institutionalized performed similarly to normals. Another study with educable retarded, spastic, cerebral palsied and normal children showed no difference between groups on this task when equated on mental age. Hallahan (1975) also cited a study where institutionalized retarded children did not differ from a normal group of children on mental age.

Further studies (Hallahan, 1975) using Hagen's Central Incidental Attention Task showed that low-achieving sixth grade boys performed

poorly compared to high-achieving boys. Also poor performance corresponded with impulsive performance on Kagan's Matching Familiar Figures Task. Hallahan (1975) reported that in several studies learning disabled (LD) children had deficient selective attention performance, using the central incidental task. Other studies using LD children or underachieving children and proximal distractors, such as the Stroop Color-Word Test, the Portable Rod and Frame Test or other embedded designs, showed less successful attending than normal children when facing distracting information. Hallahan (1975) suggested that distal distraction conditions had not found the same negative effect as proximal distraction.

A test very similar to Hagen's Central Incidental Attention Task was the Fruit-Distraction Test (Santostefano, 1964). It also investigated proximal distraction and was used to study LD students. The test was used for studying cognitive style; however, it related to selective attention research when it dealt with the inability to effectively and actively select, organize, assimilate and process information in the context of distracting stimuli or information competing for attention. Santostefano (1964) used this test for studying constricted-flexible cognitive style. He found a "brain-damaged" group from a residential-educational center did more poorly than a regular school group; however, their IQ score means were 72 and 110 respectively. Santostefano and Paley (1964) also found non-significant evidence of a developmental trend from constricted to flexible, i.e., less difficulty in selectively devoting attention to the central stimulus with age.

Santostefano, Rutledge, and Randall (1965) used 24 boys with a reading disability and 23 matched control subjects. They found that

poor readers recalled significantly more background figures in the Fruit-Distraction Test II and took significantly longer to read the distraction card. Cotugno (1981) replicated these findings with 17 subjects having reading disabilities and 17 control subjects. He concluded that there were significant differences between disabled and non-disabled readers on field articulation tasks requiring attention to relevant information in the presence of irrelevant or peripheral and contradictory information. These results are consistent with other studies of proximal distractors, particularly Hagen's Central Incidental Attention Task.

Hallahan (1975) cited evidence for an adverse effect on LD student performance from a linguistic distractor condition. With a simultaneous presentation of auditory and visual material, older LD students seemed to be deficient relative to normal in recalling the stimuli in pairs while younger LD students did more poorly than normal students in recalling the stimuli in one modality and then the other. Hallahan (1975) suggested that auditory stimuli are more distracting than visual ones.

Using other measures of attention, Hallahan (1975) cited studies suggesting a negative relationship between attention skills and hyperactivity. His own research related Hagen's Central Incidental Attention Task to behavioral observation measures of attention and hyperactivity in institutionalized learning disabled children. He stated the following:

> There was no relationship between the laboratory measure of selective attention--Hagen's C-I task--and the behavioral measures of attention and hyperactivity. Although at first glance it perhaps seems appropriate to question the utility of Hagen's task in predicting or explaining relevant behaviors of learning disabled children, the task has differentiated learning disabled from normal children. (Hallahan, 1975, p. 213)

This was an important consideration for evaluating proposed applications of research built upon this central incidental task.

Tarver, Hallahan, Kauffman, and Ball (1976) studied selective attention, using Hagen's Central Incidental Attention Task, in younger and older learning disabled boys. The study supported the idea that learning disabled students have a deficit in selective attention which improves with age. This suggested a developmental lag. They used 18 learning disabled (LD) students approximately 8 years old. They found that the central recall was greater for normal students, primarily due to the lack of a primacy (positions 1 and 2) effect. This was also cited as evidence for a verbal rehearsal deficit. It has been shown that verbal rehearsal strategies underlay primacy recall.

Tarver et al. (1976) did a second study which had two matched groups of older LD students. The average age was about 13 years for two groups and about 10 years for the other two. This study dealt more directly with the verbal rehearsal assumptions. While one matched group received the normal Central Incidental Attention Task, the other group received directions to verbally label, chunk, and rehearse the items of the task. In these older students a primacy and recency effect occurred in all groups, thus negating the influence of the special instructions of this theoretical measure of verbal rehearsal. However, a light trend to increased central measures and decreased incidental measures combined in the efficiency calculation (%C - %I) and showed rehearsal to have a significant favorable effect.

The results supported the idea of constant developmental increases in central recall with increasing age in LD students. This idea was later developed fully into a developmental lag hypothesis. Reference to the model of selective attention development in normals was used to suggest that a developmental lag of 2 years was evident. The authors further suggested that the absence of a significant decline in incidental learning at any of the age levels investigated suggested that developing verbal rehearsal strategies caused increases in central recall with age rather than improvements in selective attention. Yet the theoretical distinction between verbal encoding and selective attention was not well defined. Furthermore, the relation of the verbal rehearsal treatment to the efficiency measure (%C - %I) was not clearly defined and the results supporting this relation seemed tenuous in theory, magnitude, and the number of subjects involved.

Swanson (1979) used 15 LD students and 15 normal students on Hagen's Central Incidental Attention Task. He reported that when matched on mental age (MA), there were no significant differences between groups in selective attention scores.

Vrana and Pihl (1980) studied selective attention using both proximal and distal placements of incidental stimuli. However, there were two obvious, major faults in the study. The control group was significantly different from the learning disabled group on intelligence. Also, after making an incidental measure on the fifth card, on the sixth card an effort was made to make another incidental measure. After students

were questioned once about an incidental stimulus, they probably did not respond to the same stimulus as if it was an incidental part of the task.

Vrana and Pihl's (1980) experimental procedure was very similar to Hagen's task (the proximal condition). It provided insight on using the technique. They used solid black circles as the central recall item on large white cards with solid black squares as the incidental stimuli. The stimuli were either close to each other in the center of the card or apart from each other at each end of the card. On the second, third, fourth and sixth cards questions about the circles were used to calculate central recall. On the fifth and sixth cards, questions about the squares were used for the incidental recall, along with a question about the rows on card six.

Besides the problems already mentioned, the results were comparable with other research, with the advantage in this study that proximal and distal aspects were compared while minimizing other stimuli differences. Thus the results, that learning disabled children had significantly lower recall of central stimuli than normal children when both stimuli were presented together (proximal) but not in distal or incidental conditions, clearly agreed with the suggestions of Hallahan (1975) about proximal vs. distal distractors.

Tarver, Hallahan, Cohen, and Kauffman (1977) analyzed the previous research on verbal rehearsal and selective attention and developed a model for the developmental lag in learning disabled students based on studies of normal students and 8, 10, and 13-year-old learning disabled

students. They then extended this research with a study of 15-year-old learning disabled boys (N = 14) to demonstrate the overall pattern.

Their reliance on previous research such as Hagen's studies led them to omit any control group. Thus the assumption of a direct comparison between the trends reported for normal children and this particular experimental group seemed to run some risk of an unrecognized systematic difference being the real causal element. Use of the research literature, primarily their own studies with small sample sizes, did not seem justified, particularly with a task having limited psychometric study. Consequently, in terms of experimental design, sample characteristics and test administration in this study (Tarver, Hallahan, Cohen, & Kauffman, 1977) the absence of a control group seemed unjustified.

The results of this study (Tarver, Hallahan, Cohen, & Kauffman, 1977) were compatible with the developmental lag hypothesis. There was clear evidence of increasing selective attention at the older ages. Central recall did not differ from the 15 and 13-year-olds. But a steeper primacy effect for the 15-year-olds was used as evidence for continuing development of verbal rehearsal strategies. Reciprocity between central and incidental measures again was refuted.

A study by Hallahan, Gajar, Cohen, and Tarver (1978) attempted to explore aspects underlying selective attention differences. Twenty-eight LD junior high students completed two locus of control measures and a group selective attention measure. This measure was a modification of Hagen's Central Incidental Attention Task. The results showed that

the LD students scored significantly lower than normals on selective attention central recall. They differed significantly from normals on both locus of control measures, showing a greater degree of external control. One surprising finding was that the two locus of control measures did not correlate highly, leading the authors to speculate that the LD student's external locus of control is extremely broad. The general conclusion supported the idea of a quantitative developmental lag by showing that the LD student is inefficient in using problem-solving strategies.

Hallahan, Tarver, Kauffman, and Graybeal (1978) began the effort to relate the research on selective attention and the developmental lag more directly to the teaching techniques mentioned in several previous articles for making learning disabled children more actively involved in using problem solving strategies. First they developed a new version of Hagen's task that would allow repeated tests. Three different classes of stimuli were used, i.e., animals, household objects, and geometric figures.

Using this instrument they investigated the effects of reinforcement and response cost. In the reinforcement condition (R) the subject received 3¢ for every correct first card and 1¢ for the second card. A response cost condition (RC) caused a loss of 3¢ for every incorrect response from 60¢ initially given. The control condition (C) allowed 2¢ for responses to both cards.

The reinforcement condition resulted in both a recency and a primacy effect, while the others showed only a recency effect. A measure of the child's efficiency in focusing on high payoff (first probe) versus

low payoff (second probe) was presented as analogous to selective attention. Thus the significantly better performance under reinforcement for recall of first-probed stimuli (7.56) than second-probed stimuli (3.81) was explained as showing the child giving up attention to the low payoff stimuli. However this theoretical relationship needed to be examined more closely.

The same relation between a primacy effect and verbal rehearsal suggested that LD students in the reinforcement condition were using a verbal strategy to attend better. This suggested to the authors that the LD child is able to use an appropriate strategy, and usually has difficulty because, even knowing mediators, he is unable to produce them at the appropriate time. The study by Hallahan, Tarver, Kauffman, and Graybeal (1978) clearly agreed with the earlier research findings and their implications for programs. The following by Tarver, Hallahan, Kauffman, and Ball (1976) was still supported:

> A gradual, though slower rate of progression through the normal developmental sequence is indicative of a quantitative learning deficit, and suggests that those procedures which have been found to increase rate of learning in all populations, e.g., repetition and reinforcement, should be emphasized in the education of the learning disabled. In contrast, confirmation of a more basic, qualitatively different mode of cognitive functioning would imply that teaching methods should be qualitatively different for the learning disabled and normal children. (p. 383)

Torgesen (1981) summarized much of his research on attention and memory by saying that LD students have a less active, organized approach to memory tasks. These were defined as control process inefficiencies.

This was compatible with the idea of a developmental lag producing a quantitative problem. Torgesen even suggested intervention strategies for learning to compensate for control process inefficiencies. He mentioned the use of incentives or reinforcement programs, the use of direct instruction in processing strategies, and the use of orienting tasks, such as those that require the repetitive manipulation of material. There have also been studies using relaxation training or desensitization training to improve attending, such as the study by Omizo and Michael (1982) with hyperactive boys.

Argulewicz (1982) also used a direct intervention. Subjects were trained in attending behaviors. Compared to a group only exposed to modeling, this group did significantly better on the indexes of selective attention used in the study. The indexes chosen were the digit span subtest of the Wechsler Intelligence Scale for Children--Revised (WISC-R) and the Memory for Sentences II (MSII) subtest of the Stanford-Binet Intelligence Scale. In Section Three of Chapter IV these measures were compared to Hagen's Central Incidental Attention Task.

Educational procedures falling under the rubric of cognitive behavior modification have been suggested for the strategy-deficient inactivity of learning disabled students. In one example, an LD student was taught to monitor his on and off-task behavior, using a cue from a tape recorder to pace his monitoring. On-task behavior in math and handwriting was dramatically increased. Eventually use of the tape recorder, and then self recording were gradually phased out (Hallahan, Lloyd, Kosiewicz, Kauffman, & Graves, 1979).

In another study Hallahan, Marshall, and Lloyd (1981) used self-recording to increase on-task behavior of three severely LD students in one reading group. Observer ratings of the on-task behavior showed a doubling due to self-recording. They also gradually withdrew wrist counters and then the tape recorder. Lloyd, Hallahan, Kosiewicz, and Kneedler (1982) did a comparison of self-assessment and self-recording. Self-assessment consisted of the student asking himself whether he was paying attention when he heard the tape-recorded cue. Using three subjects in the second part of the study, self-recording was found to be superior to self-assessment, but neither increased productivity.

A final approach to investigating selective attention dealt with the student's awareness of his attending, i.e., meta-attention. Loper, Hallahan, and Ianna (1982) developed an instrument to measure meta-attention in LD students. Performance on the meta-attention task corresponded to academic achievement for normal subjects, but not for the LD students. They also noted a developmental trend from younger children being more impressed with rewards to older children placing more value on interest when asked the circumstances leading to better attention.

Tarver (1981) attempted to integrate this research using the term underselective to refer to LD attention behaviors. Her article described the development of explanations based on the results of studies of underselective attention. Early explanations of distractibility were refined to differentiate proximal distractors for measuring selective attention.

Next analysis of the patterns of central recall scores by serial position led to identification of a primacy effect deficit. This was

interpreted as a verbal rehearsal deficit. Evidence of a failure to use effective verbal rehearsal strategies, even when known by the subject, also suggested problems with metacognition. Other research has studied how linguistic subskills of attention and memory contribute to the LD information-processing deficit. She also outlined the creative ability hypothesis. Thus the LD child's underfocused, underselective attention might have been indicative of high creativity.

Investigations of selective attention have led to a wide range of related investigations. The most important concern was the distinctive academic deficit that LD students experience. The merit of these other constructs will ultimately be the degree to which they explained and helped to remediate the academic problems. The effectiveness of precision teaching in interacting with the selective attention deficits to produce reading achievement was an example of these critical basic investigations.

Precision Teaching

Attending Behavior

The behavioral approach to attention described it as an unobservable, unmeasurable phenomena, and attending or its actual verification through observable responses is the relevant concern (Haring, 1968). Thus the question of attention centered on the teacher's efforts in guiding attending and responding to relevant dimensions of stimuli. Attending was a learning behavior. Haring (1968) further asserted that "faulty attending and inaccurate, slow responding can be corrected through more precision

in the manipulation of instructional conditions available to the classroom" (p. 45). Precision teaching used most of the features of applied behavior analysis recommended by Haring. Thus it should be particularly helpful in guiding attending and responding to relevant dimensions of stimuli.

If a history of ineffective patterns of attending was also reflected in a minute sample of behavior, Hagen's test, then it could be used to test whether academic performance corresponds to student's attending patterns even when teaching with a program guiding attending. Precision teaching should be particularly effective with those students with poor selective attention performance. One assumption, which is not supported by a behavioral view, was that poor selective attention performance corresponded to a history of academically ineffective patterns of attending.

General Features

Mercer and Mercer (1981) described applied behavior analysis (ABA) as one of the newer approaches in special education. They outlined its features as including (a) measurement systems, (b) precision teaching, (c) instructional aims, and (d) learning principles.

> Thus, precision teaching is characterized by a direct, continuous, and precise measurement system, and it provides an accurate measurement of student progress. The teacher can obtain a record of past performances, a plan for where the student is going, and an estimate of when the student will get there. (Mercer & Mercer, 1981, p. 6)

Precision teaching is "one way to plan, use, and analyze any teaching style, technique, method, or theoretical position--old or new" (Kunzelman, Cohen, Hutten, Martin, & Mingo, 1980, p. 12).

Bradfield (1971) outlined four components to precision teaching. The first was the system of recording and charting data, using a chart such as the six-cycle logarithmic chart developed by Lindsley. The second component was the need for precise selection and definition of the target behavior, called "pinpointing." Bradfield (1971) emphasized two of Lindsley's basic characteristics for "pinpointed behaviors" or "movements": (1) They must be a complete movement cycle, having a definable beginning and end; (2) They must pass the "dead man's test," i.e., if a dead man can do the behavior, it can not be counted. The third component Bradfield (1971) used is Lindsley's IS-DOES formula. This referred to the five basic parts of the learning environment. In the IS formula, the five parts were parts that only have the potential to change behavior. They are as follows:

1. Program, environmental setting such as location, time of day, etc.
2. Antecedent event, factors such as instructions, demonstrations, materials which might result in the behavior.
3. Movement cycle, the behavior being measured.
4. Arrangement, the numerical ratio between the movement and the subsequent event.
5. Subsequent events, events which may result from the movement cycle such as praise, grades, withdrawal of privileges, etc.

This DOES part of the formula is reserved for when these have demonstrated a behavioral function and become the following: (a) disposition

components, (b) stimuli, (c) responses, (d) contingencies, and (e) consequences. The final, fourth component outlined by Bradfield is the Behavior Bank. It used a computer to store cases as examples of procedures for particular behavior problems.

Mercer (1979) presented a very concise description of the teacher's activities in precision teaching. They include the following: (a) selecting a pinpoint or target behavior; (b) developing a task sheet or probe for evaluating pupil progress in daily timings; (c) graphing these data daily, setting instructional aims, and particularly teaching; and (d) analyzing the data and making instructional decisions.

The critical elements were the measurement, the rate of the behavior, and the charting of this measurement. This usually meant that frequency, the count of behaviors divided by the number of minutes, was recorded on the Standard Behavior Chart. The chart's sensitivity ranged from 1 movement per 1440 minutes (24 hours) to 1000 movements per minute (Koorland and Martin, 1975). The widespread use of this chart promised to improve communication between researchers and instructors.

Related Terms

The following were some terms used in precision teaching:

Accuracy Measure--The proportion of correct behaviors to inappropriate behaviors.

Frequency--How often something happens in a certain unit of time.

Celeration--The measure for summarizing the trend and direction of day-to-day frequencies on a chart.

Acceleration--A daily increase in the celeration line.

Deceleration -- A daily frequency value decrease causing the celeration line to move down the chart.

Aims -- The specification of precise pupil response, the conditions surrounding it, and the criteria for acceptable performance.

Proficiency -- The level of student performance that is automatic enough to show a desired frequency (rate) representing the performance of successful performers, reflecting mastery.

Validation Studies

The Precision Teaching Project of Great Falls, Montana, was one of the most successful projects in the country (Beck, Note 3). Six schools were used in the study, two with 5% of their families' incomes under $5,000, two with 12%, and two with 20%. One member of each pair was randomly assigned to the experimental group. The study involved students in kindergarten and grades one to three who had "learning deficits." The degree to which this category overlapped with learning disabilities is not known. The screening for this group involved performing at one-half or less of the median celeration of classroom peers. Though screened in exactly the same manner, learning deficit students in the control schools were not identified until the project was completed. In the experimental schools the remediation consisted of only 20 to 30 minutes per day, utilizing minute drill sheets focusing on basic tool skills.

The results included the three grades in the three types of schools with three behaviors: write numbers, hear-write numbers, and see-say letters. Nineteen of 27 pretest comparisons showed no significant difference

or a significant difference favoring the control groups. Of these 19 comparisons, the posttest results for 14 showed the experimental groups to be significantly superior. Three comparisons showed no differences. Only one, the see-write numbers task in grade two of the second type schools (12%), had no significant difference on the pretest and significant difference favoring the experimental group on the posttest. Analysis of eight cases, five being see-say letters tasks, was not yet available because the experimental groups were superior on the pretest. Finally, in rating the educational importance of these studies, the report noted the following facts (Beck, Note 3):

1. The magnitude of the effects of precision teaching were large.
2. The procedure was most effective in grade 1.
3. The procedure was not sensitive to economic status.
4. Its continued use was inexpensive.

Next a precision teaching approach to regular education was developed (Beck, Note 4). Precision teaching was implemented at Sacajawea Elementary School. This implementation actually focused on the following five components:

1. Screening and Identification
2. Direct and Daily Measurement
3. Charting
4. Data Decisions and Instructional Intervention
5. Support (Materials Bank)

Another school was designated initially as having equivalent or relevant

variables of socio-economic status and achievement test patterns. Over a previous four year period, there was no difference in the schools.

The Sacajawea first grade precision teaching pupils had significantly higher reading scores (an eight month gain) on the Wide Range Achievement Test (WRAT) reading subtest. There developed a large percentile difference between the schools, favoring the precision teaching subjects. The Iowa Tests of Basic Skills was used to compare fourth grade students for four years. During the year with no treatment and the first year of precision teaching there was little difference between Sacajawea and the district. During the third and fourth years (1976-77) there was a dramatic improvement over the district of +24 percentile points in reading and +32 percentile points in math.

<u>The SIMS Program</u>

The Systematic Instructional Management Strategies (SIMS) Program was originally designed to provide a comprehensive self-contained educational program for severely learning disabled students. The Armatage SIMS Center was established in 1972. Based on its success, the program was extended to include resource rooms which serve the mild to moderately learning disabled students (Harvey, Note 5; Wiseman, Note 6).

There were two aspects to this program, the SIMS materials and the SIMS procedures. The SIMS materials included a highly structured phonics sequence which encompassed the basic coding skills of reading and spelling. Coding skills were divided into 53 categories. Each category had two category word lists, sentence lists, and four stories.

The procedures advocated that in each category a 90-100% performance criterion be used for accuracy. Proficiency was monitored daily on word lists with a criteria of 40-60 words correct per minute with two or less errors for mastery. Daily rates for the stories suggested 80-100 words correct per minute with two or fewer errors. In this way the SIMS program combined task analysis, criterion referenced teaching and testing, contingency management, and precision teaching (Harvey, note 5; Wiseman, Note 6).

SIMS Evaluation

Though the SIMS program used precision teaching and individual charts, group comparisons were used to assess the program's effectiveness in the 1976-77 year. Students made statistically significant gains. The SIMS group was also compared to the students in the Minneapolis Special Education Division school based resource program. The SIMS students were originally chosen from these same resource programs based upon their failure to make "acceptable gains." The results showed a 1.05 average gain, with 0.77 being the gain by the elementary students in the year prior to being in the SIMS program, and with .84 being the gain of the comparison group. The report also presented charts of the average student's time in each category and the weekly celeration rate for each category (Harvey, Note 5).

When the validation report was submitted to HEW's Joint Dissemination and Review Board (JDRP), WRAT reading standard scores were compared between the SIMS group ($N = 118$) and the control group ($N = 147$) yielding a significant difference ($p < .001$). In the evaluation for the 1977-78

year, t-tests between SIMS students' pre-posttest gains were greater than might be expected by chance ($p < .001$). A second comparison, practiced by the United States Office of Education, compared the average gain to one-third the normed standard deviation of the test, "suggesting the gain is educationally significant" (Wiseman, Note 6, p. 27).

Thus there was evidence supporting the SIMS as a successful precision teaching program, though some of the analysis seems weak or inappropriate. The use of gains scores has well-known inherent weaknesses. The extension of this into a predicted gain score using the following formula seemed unjustified:

$$Y^1 = \frac{\text{Score}}{\text{Years}} \times \text{Time}$$

Score = years in school at time of entry

Time = time elapsed between pre and posttests

Furthermore, there were reasons to expect that all LD students would make some improvements in reading in this program. But student performance while in this program could be used to represent reading achievement in studying the relationship of student's visual selective attention levels to reading performance.

Modality Processing

Background

Selective attention referred to a method of information processing while modality processing also referred to the way information was processed. Thus several research questions asked how selective attention

scores corresponded to modality aptitude scores. They were attempting to clarify whether one process underlay the other, whether they were separate processes, or whether they were both expressions or symptoms of other underlying processes.

This question was very important because the concern for psycholinguistic or modality processes was one of the earliest and most distinctive characteristics of research, identification, and remediation of learning disabilities. Most definitions of learning disabilities, except for the behavioral definitions like those used with precision teaching, still defined it as due to underlying psychological processes. Psychological testing focusing on cognitive, perceptual, and expressive abilities of these students had been used to identify, diagnose, and to suggest special instructional strategies and materials. Modality preference was one of the more global aspects of these psychological processes.

The modality model referred to LD students as primarily auditory or visual learners according to relative strengths and weaknesses in their auditory and visual channels. Matching the modality preference to particular teaching strategies had been studied as possible aptitude - treatment interactions (ATI).

Arter and Jenkins (1977) found that with LD teachers in Illinois, 97% were familiar with the modality model, 95% believed research supported it, 99% felt modality should be a major consideration in educational prescriptions, and 78% reported using it frequently. Of 700 questionnaires

sent out, this analysis was based on 340 (48.57%). Olson, Mercer, and Paulson (1981) suggested that testing for a process disorder is continuing, even when such a determination was not required in the criteria for identifying a learning disability.

Research

Two testing instruments that were widely used to measure such abilities in LD children were the Detroit Test of Learning Aptitude (DTLA) and the Illinois Test of Psycholinguistic Ability (ITPA). Numerous research studies, often using the ITPA, have failed to establish the utility of modality preference for instructional strategies. Very little research has investigated if the DTLA measures psychological processes related to academic performance.

The study by Sandstedt (1964) used the DTLA with 45 LD students. She found students were more successful with the visual test of unrelated objects than with the auditory test of unrelated words. This was a significant difference. Olson, Mercer, and Paulson (1981) used the DTLA with 65 adolescents. In correlations with the WRAT and DTLA, the highest were oral directions correlating .35 with math, verbal opposites correlating .33 with reading, and auditory attention span for objects correlating .27 with reading. It was also interesting that visual attention span for objects correlated -.03 with reading. They concluded that the DTLA measures are not related to academic achievement.

Braggio, Braggio, Varner, Smathers, and Lanier (1980) studied the relation of optimal response modes in 34 LD students to methods of task

presentation. The students' optimal response mode was determined by administering 10 subtests of the DTLA. Items missed from five selected subtests were then randomly assigned to several methods of task presentation. One possible criticism was that the five subtests were all heavily visual; however this may have been necessary for several options in task presentation. In the first condition, the cover response (CR) condition, the student could make no visual or auditory response. In the vocal response (VR) condition the student told the examiner what was required for a correct response. On the last, the visual-manual response condition (V-MR), the student demonstrated the response by moving a finger. Then a DTLA posttest allowed a determination of which method produced the greatest decrease in errors and was thus the optimum response mode. Then a paired associate task was administered using a method of task presentation that resembled the optimal response mode. In the unmatched condition, the presentation was in the least effective mode. Using a one-way ANOVA, a significant main effect for CR, VR, and V-MR treatments was found. On the paired associate task, significantly more paired-associate items were recalled under the matched condition. They explained their results by saying that "LD children may have difficulty filtering the demands of the task from irrelevant cues . . . and then selecting the optimal response mode" (p. 94).

Lilly and Kelleher (1973) found a significant interaction using educationally handicapped subjects and simply one modality memory tasks. The tasks were very similar to the auditory DTLA attention span for

unrelated words and the visual attention span for objects except that in the visual test words were used instead of pictures. Stories from Level 2 of the Durrell Analysis of Reading Difficulty were presented on tape or print. Students scoring highest on the visual test performed best on the print while students scoring highest on the auditory test performed best on the tape.

Bursuk (1971) classified 90 readers by their sensory modality learning preference. She used aural-visual teaching and only visual approaches. There was not a simple interaction since all subjects in the aural-visual approach performed significantly better than the other group. However the aural-visual approach appeared to be more effective with the auditory learners while the visual approach was more effective with visual learners. However, this was not clear evidence for a modality-treatment interaction since the aural-visual treatment involved both modalities and possibly required more involvement or attention.

Using normal students, Robinson (1972) found only auditory discrimination contributed to reading achievement for both sight and phonics programs over three years. Ringler and Smith (1973) used modality specific treatments, though all subjects received pictoral materials and oral discussion, resulting in no significant differences among groups. Vandever and Neville (1974) found no differences between groups taught to modality strength or to weakness. Smith (1971) used culturally disadvantaged students and found no significant differences. Foster, Reese, Schmidt, and Ohrtman (1976) also found significant differences favoring

audible learners when taught by auditory methods, but there was no significant disordinal interaction. Newcomer and Goodman (1975) failed to find an ATI interaction with 167 fourth grade subjects. They did find that the modality variable was most important for low auditory learners. The visual treatment mode was superior for both modality preferences. In an attempt to relate auditory or visual psycholinguistic skills to phonic decoding (more auditory) or sight-word reading, Richardson, DiBenedetto, Christ, and Press (1980) concluded that subjects can not be "successfully sorted into auditory and visual learner categories" (p. 77).

Several people have reviewed large numbers of studies looking for a modality and treatment interaction. Arter and Jenkins (1977) found only one supporting study out of 15. Haring and Bateman (1977) listed the results of the first review and mentioned three additional studies that related reading instruction to traits other than relative modality patterns. They reported one significant modality interaction in addition to the Bursuk (1971) study. Silverston and Deichmann (1975) discussed many of the same studies. They pointed out the lack of investigation into relationships of tactile and kinesthetic modalities to reading as well as the need for more investigations of perceptual shifting and reading. Ysseldyke (1973) reviewed many of these same studies and pointed out some of the problems in looking for ATI relations. He also said many problems were due to the lack of ITPA subtest reliability.

Tarver and Dawson (1978) reviewed 15 studies dealing with the interaction of perceptional modality preference and method of teaching reading, including 11 studies covered in the other reviews. The results showed no interactions between modality preference and the method of teaching reading.

Larrivee (1981) also reviewed studies for the effect of modality preference on commercial reading programs in schools, specific reading skills using reading related treatment tasks, and comparisons of auditory and visual modes as mediational channels. She emphasized that in most studies it was difficult to identify preferred modality. Many studies used different measurement instruments. Often classification was seemingly arbitrary and only a small percentage of the subjects showed a marked preference. Most measurement devices lacked the necessary reliability. She concluded that differentiating instruction by modality preferences did not facilitate learning to read.

Hammill and Larsen (1974) provided one of the most comprehensive reviews, covering 39 studies using the Illinois Test of Psycholinguistic Ability (ITPA). Of the 280 experimental-control comparison, only 106 supported training of psycholinguistic skills. One interesting point in their table was that 11 articles dealt with educably mentally retarded subjects, five with trainably mentally retarded subjects, 19 with disadvantaged subjects, and four with "other" subjects. The category of LD was not presented in the table codes. The conclusion was that "the efficacy of training psycholinguistic functionings has not been conclusively demonstrated" (p. 12). Minskoff (1975) provided a criticism of many aspects of Hammill and Larsen's (1974) review. Three major problems involved the incompatibility of the nature of the subjects, the nature of the treatments, and the experimental designs. She emphasized that many of the subjects did not have learning disabilities.

Lund, Foster, and McCall-Perez (1978) reanalyzed 24 of the same 38 studies. They found that six studies showed positive results. Of 10 studies reported as showing negative results, they reported four actually showed positive results and were reported inaccurately. They reported that two others contained insufficient data, and two compared treatment groups instead of trained versus untrained groups. An additional three studies were positive but limited in scope. Finally, the last four studies had miscellaneous problems in the way they were reported.

Hammill and Larsen (1978) replied by focusing on the 10 articles showing negative results. They agreed that one study reported as negative was actually positive, but the other three were correctly reported. They also replied persuasively to the other criticisms.

Larsen and Hammill (1975) also did a review of 60 studies of visual perceptual abilities and school learning. They found the results to be mainly contradictory. The major contaminating influence was the fact that most studies lacked control for age and intelligence.

Kavale and Glass (1981) explained the need for meta-analysis in exceptional education using the effect size statistic. They cited the example of the psycholinguistic debate as an example of the need for this more systematic technique for generalization across studies. Kavale then did a meta-analysis of visual perceptual skills and reading (Kavale, 1982). Kavale (1981) also performed a meta-analysis on the literature assessing the efficacy of psycholinguistic training.

He examined the original 38 studies and six additional studies since 1974. Six were not obtained and two were eliminated, so he based the analysis on 36 studies. He concluded that the literature had demonstrated the effectiveness of psycholinguistic training.

Larsen, Parker, and Hammill (1982) replied with a series of criticisms of Kavale's study, primarily focusing on the articles chosen since Kavale (1981) did not use all of the same studies. They also performed their own meta-analysis including the additional studies. In no case did the change due to training exceed the standard error of measurement (SEM). Again the results failed to demonstrate that psycholinguistic training had value.

Torgesen (1979) pointed out that in addition to the controversy over training psycholinguistic processes, generalization to academic skills still lacked solid evidence. He suggested that task-centered process assessment be substituted for the child-centered process assessment. This would be a type of task analysis to measure the processes required for the performance of specific academic tasks in specific settings.

A unique approach to the problem was the single subject design study by Koorland and Wolking (1982). Using behavior analysis, they investigated the consistency of modality preferences across tasks when reinforcement contingencies were either consistent or inconsistent with the preferences. Experimental control was demonstrated rapidly. When reinforcement contingencies favored visual responding, visual

responses more than doubled the baseline, and exceeded the auditory responses (two out of three). The surprising result was that, using reinforcement, performance in the nonpreferred modality approached or even exceeded performance in the preferred modality.

These results suggested that modality preference is heavily influenced by the reinforcement the subject receives. Thus it would seem that modality preference was a measure of learning heavily influenced by whatever reinforcers the subject had been receiving. This explanation was compatible with the ambiguity of the research in the area.

Multisensory Teaching

Multisensory approaches to teaching reading and spelling have been used with reading disabled students since the 1920s. The modality processing theories about learning disabilities reinforced the use of these reading approaches. The theories explained program effectiveness as due to overcoming the limits of weak modality processing by using several modalities, some stronger, to reinforce each other. Thus the literature on modality preference, particuarly on aptitude-treatment interaction, also applied to multisensory teaching.

One of the most widely known techniques is the Visual-Auditory-Tactile-Kinesthetic (VAKT) Technique (Fernald, 1943). This technique was used with the comparison group, in place of the SIMS program, for the Section One comparisons in this dissertation.

Thorpe, Lampe, Nash, and Chiang (1981) did a single subject design study comparing the VAKT technique to a visual-auditory technique.

The results showed the VAKT to be the superior procedure. A review of the literatue by Myers (1978) reported 16 studies where the method was useful or successful, and several studies where the results were negligible. His conclusion was that there was little research finding "differences of gain in reading" when using the multisensory approach. The VAKT technique does represent a widely used method representative of traditional LD reading remediation.

CHAPTER III

METHODOLOGY

The purpose of this research was to investigate the importance of visual selective attention to learning disabled student's reading performance. Eleven hypotheses were used to investigate the important aspects of this study. They were designed to especially compensate for two major limitations in the selective attention literature review, i.e., the size of the learning disabled (LD) student samples studied, and the relevance of the cognitive concept, selective attention, to the reading performance of students in precision taught reading programs.

Hypotheses

Section One

As stated earlier the research questions were investigated in three sections. The first section used three small samples of subjects. These subjects were either in the SIMS reading program, in a traditional LD reading program (the Visual-Auditory-Tactile-Kinesthetic or VAKT approach) or, for the small sample of students referred but not admitted to the LD program, in a regular classroom basal reading program. This section investigated hypotheses 1 and 2.

Hypothesis 1. Precision teaching improves attending and thus alleviates selective attention's effects on reading performance among the three reading groups. Therefore, a VAKT taught group's reading scores will be most influenced by selective attention, a precision (SIMS) taught LD group's reading scores will be less influenced, and a non-LD group's scores will be least influenced by the student's selective attention level.

This first hypothesis investigated the research question which asked if precision teaching (SIMS) favorably affected attending behavior enough that LD students experiencing reading problems attributable to selective attention would be differentially helped compared to other reading teaching methods. It also revealed how reading performance in all groups would be influenced by selective attention.

Hypothesis 2. Selective attention will relate to reading performance, i.e., lower visual selective attention performance is related to lower reading achievement performance. This will be shown by the total task performance measure, combined selective attention (C + I), more strongly than it will be shown when measured by the percentage selective attention measure (%C - %I). This last measure has often been used as an indication of selective attention efficiency (Tarver, Hallahan, Kauffman, & Ball, 1976).

This hypothesis investigated whether the relationship between selective attention and reading was best characterized as due to the limited filtering or limited capacity process defined in the literature (%C - %I), or to the student's total processing capacity under distraction (C + I). It used both ways of defining selective attention.

Section Two

The second section used a sample of LD students in the SIMS program larger than most of the selective attention research groups. It investigated hypotheses three though seven.

Hypothesis 3. Among three groups of LD students differing in selective attention, the most effective selective attention group will have the highest reading achievement score. The less effective selective attention group with good ability will have lower reading achievement scores. The less effective selective attention group with low memory/attention ability will have the lowest reading achievement scores.

This hypothesis investigated the research question asking whether grouping LD students by selective attention performance would show differential reading improvement among the groups. The three groups of students were identified according to their scores on the Hagen's Central Incidental Attention Task. Group one had the poor selectors, i.e., students showing poor selective attention but better memory or attention. Group two had the poor performers, i.e., students with both low selective attention and low memory/attention performance. Group three had the subjects who showed little distraction with good selective attention performance.

Hypothesis 4. Selective attention will relate to reading performance on the Wide Range Achievement Test (WRAT). Low selective attention performance will be more closely related to low reading achievement when measured by combined selective attention (C + I), than when measured by the composite, selective attention efficiency measure (%C - %I).

This hypothesis investigated the question which asked if selective attention's effect on reading performance would be explained better by the incidental performance limiting central performance efficiency measure (%C - %I) or by the total capacity measure (C + I). This was similar to hypothesis 2 in comparing the different reading methods except that it used the large LD student sample.

Hypothesis 5. The visual selective attention task will relate to modality test performance so that students low on visual modality aptitude will score low on visual selective attention, resulting in a high correlation. This will also help clarify any interaction between different but related underlying cognitive structures.

Hypothesis 6. The selective attention task theoretically measures an underlying LD student characteristic. Therefore more of this variance will be explained by student modality preference (Detroit Test of Learning Aptitude) than by student IQ scores.

These hypotheses examined how visual modality aptitude, one of the first "process" constructs used for explaining learning disabilities, related to selective attention. Low visual selective attention was expected to relate to low visual modality aptitude, and these would be related more to the processes underlying the specific learning disability than to general cognitive processes. Investigating these relations provided information on how the two psychological constructs related to each other.

Hypothesis 7. Differences between the students' LD teachers will influence their reading achievement scores more than the influence

of the students' selective attention performance. This hypothesis was intended to make sure that any effects ascribed to selective attention were not due to other influences, such as teacher differences.

Section Three

The third section used students from the first section. It compared their performance on several other tests to their initial performance on the selective attention task.

Hypothesis 8. Scores obtained from Hagen's Central Incidental Attention Task will correlate significantly with other measures of selective attention. This used the indices recommended by Argulewicz (1982).

Hypothesis 9. Hagen's Central Incidental Attention Task scores will correlate significantly with meta-attention scores, revealing a developmental trend from reward orientation to interest orientation. These two hypotheses were inteded to help determine when Hagen's Central Incidental Attention Task was measuring the same underlying selective attention construct as other instruments and techniques used to study attention.

Hypothesis 10. Practice effects in a test-retest administration of Hagen's Central Incidental Attention Task will produce an improvement in incidental task scores at the expense of central task scores. These data were intended to clarify the filtering or limited capacity ideas by readministering the task.

Hypothesis 11. Teacher ratings of classroom attending behavior will correlate significantly with LD student performance on Hagen's Central Incidental Attention Task.

This hypothesis represented an attempt to clarify the relation between attending behavior in the classroom and the experimental instrument. The attending behavior in the classroom should have been adequately represented by ratings given by the student's regular classroom teacher.

Research Design

This study was designed to systematically proceed through the investigation of these 11 hypotheses in three sections. Each hypothesis will be the subject of a separate analysis. Each section represented a different group of subjects.

In Section One, the first analysis used three reading groups from Marion and Brevard Counties, the SIMS program LD group, the VAKT (Visual-Auditory-Tactile-Kinesthetic) program LD group, and the classroom program non-LD group. Later, because of the small size of the third group, only the SIMS and VAKT program groups were used. In Section Two a different, larger group of LD students in the SIMS program in Marion County was used. In Section Three a small sample of students from Section One was used again. These group labels, i.e., SIMS, VAKT, and Regular, are used in Table 1 to clarify the variable involved in the testing of each hypothesis. Specific information on the subjects will be given later.

Table 1

Variables Examined for Each Hypothesis

Hypothesis #	Subjects Number	Group	Independent Variables	Dependent Variables
1.	19 20 11	SIMS/Marion LD VAKT/Brevard LD Non-LD/Brevard	S. Attention Groups (2) Rdg. Programs (3)	PIAT Reading
2.	19 20	SIMS/Marion LD VAKT/Brevard LD	S. Attention R. Programs (2)	PIAT Reading
3.	67	SIMS/Marion LD	S. Attention Groups Age Group (4)	WRAT Reading
4.	67	SIMS/Marion LD	S. Attention	WRAT Reading
5.	67	SIMS/Marion LD	S. Attention Mod. Pref. Group	WRAT Reading
6.	67	SIMS/Marion LD	Mod. Pref. Group IQ Score	S. Attention (C + I)
7.	67	SIMS/Marion LD	S. Attention LD Teacher	WRAT Reading
		CORRELATIONS		
8.	16	VAKT/Brevard LD	(C) WISC-R Digit Span (C) Stanford-Binet Subtests	S. Attention Subscores

Table 1 — continued

Hypo-thesis #	Subjects Number	Group	Independent Variables	Dependent Variables
9.	16	VAKT/Brevard LD	(C) Meta-Attention Task	S. Attention Subscores
10.	16	VAKT/Brevard LD	(C) Selective Attention Task	S. Attention Task
		SPEARMAN CORRELATIONS		
11.	16 11	VAKT/Brevard LD Non-LD	Attending Behavior Ratings	S. Attention Task

C = Continuous variables

Independent Variables

As shown in Table 1, the independent variables were measures of student characteristics. They included selective attention performance, modality preference group, intelligence (IQ) scores, and chronological age.

Selective attention. Selective attention performance was obtained from the results of testing with Hagen's Central Incidental Attention Task (Mercer, 1975). These results, including the subtests, were reported the following five different ways:

1. Central Scores (C)
2. Incidental Scores (I)
3. Selective Attention Efficiency Index (%C - %I)
4. Selective Attention Combined Capacity (C + I)
5. Selective Attention Level

The central task score (C) was expected to reflect primarily attention and memory processes, like a recall test. The incidental task score (I) was much more sensitive to attention or selective attention and was expected to vary more within the subject.

The selective attention efficiency index (%C - %I) was used in several research studies (Tarver, Hallahan, Kauffman, & Ball, 1976). It produced an overall score that attempted to reflect the idea that performance on the incidental measure (I) reduced the capacity for performance on the central measure (C).

The combined selective attention measure reflected the total capacity for attention under the interaction, distraction, and capacity limitations of the two measures (C + I). Because there are 12 central items and six incidental items, the score was weighted toward the assigned task. Consequently, poor selection emphasizing the incidental stimuli would lower the central score more than it could have potentially raised the incidental score.

Two types of assignments to levels based on selective attention performance were used. In Section One, only high and low selective attention performance levels were identified:

1. High: performance with a central score greater or equal to 6, and a selective attention efficiency index greater than 8%.
2. Low: performance on C or on the efficiency index less than the high level's criteria.

In Section Two, three performance levels were identified. These were first differentiated by observation, looking for people who did well on the central task while showing some attention to the incidental task. The three levels found were as follows:

1. Level one - poor selectors with a central score less than or equal to 8 and a total score (C + I) greater or equal to 9.
2. Level two - subjects with poor overall performance having central scores less than or equal to 8 and a total score (C + I) under 9.
3. Level three - subjects with good selective attention performance having central scores equal to or greater than 8 and incidental scores under 5.

Groups one and two differed in the overall level of performance. Group one only showed poor selective attention while still attending and remembering a lot of information. Group two had a more general problem, either in attention or memory, and showed both poor selective attention and also overall poor performance.

Modality preference. This was determined by ratings of LD student's performance on the Detroit Tests of Learning Aptitude (DTLA) (Baker & Leland, 1967). The ratings were performed in a global manner, using low age-equivalent scores previously reported by teachers as evidence of the LD disorder (Appendix A). These scores were identified by the teacher as 80% or 70% or less of the expectancy age (EA) calculated as

$$\frac{2 \times MA + CA}{3} = EA$$

But rather than emphasize this quantitative approach, using very inadequate norms, these ratings consisted of recognizing overall patterns in the low scores reproted as follows:

1. Group 1: low scores in visually oriented subtests only
2. Group 2: low scores in auditorily oriented subtests only
3. Group 3: low scores in both areas or no low scores.

Intelligence scores. These are total IQ scores reported from individually administered intelligence tests. Most of the scores were from the Slossen or the Wechsler Intelligence Test for Children - Revised (WISC-R).

Chronological age. Ages were reported in years and decimal fractions of years. This was the age at the first testing with Hagen's Central Incidental Attention Task.

Data Collection

The following types of data were collected:

1. The description of the student diagnosed as learning disabled (LD) included the student's chronological age, intelligence test score or mental age, a number indicating different teachers' classes, and the teacher's judgment as to whether hyperactive or emotional behaviorwas also exhibited by the student in addition to his LD learning problems.
2. The achievement test performance included scores on the instruments at the end of the 1979-80 school year, and at the end of the 1980-81 school year. The analysis focused on the oral reading scores (decoding) and comprehension scores from the Peabody Individual Achievement

Test (PIAT) for Section One and the Wide Range Achievement Test (WRAT) for Section Two. Spelling and mathematics test performance was recorded but not analyzed (Appendix E).

3. Modality performance was obtained by rating teachers' reports of low subtest scores on the Detroit Test of Learning Aptitude as explained above.
4. The scores on Hagen's Central Incidental Attention Task were recorded as a central score, an incidental score, an efficiency index (%C - %I), and combined capacity (C + I). It was administered at the end of the 1980-81 school year.

The rest of the data was obtained only on certain subgroups.

5. All the elementary level LD teachers in Marion County (N = 15), including those involved in this study, were asked to complete a questionnaire giving their opinion of the SIMS program at the end of the 1980-81 school year (Appendix F). Seven of this group completed the same questionnaire at the end of the 1981-82 school year.
6. Additionally, teacher ratings were obtained on the 31 Brevard County students at the end of the 1980-81 school year. This included the 20 LD students in the VAKT reading program and the 11 non-LD students

in the regular classroom program. These were ratings of the LD student's attentional behavior in the classroom (see Appendix C). The ratings were again collected on 16 subjects remaining from the original group at the end of the 1981-82 school year.

7. As shown in Table 1, 16 subjects from the Brevard VAKT group received additional testing at the end of the 1981-82 school year. These results provided information for developing correlations with the initial administration of Hagen's Central Incidental Attention Task. First the indices of selective attention used by Argulewicz (1982) were obtained by using the Wechsler Intelligence Scale for Children - Revised (Wechsler, 1974) and the Stanford-Binet Intelligence Scale (Termin & Merrill, 1973).
8. Next a meta-attention task devised by Loper, Hallahan and Ianna (1982) was administered to the 16 subjects.
9. Hagen's Central Incidental Attention Task was also readministered to these 16 subjects, providing a one year interval between testing.

Data analysis. The general relationship and distribution of the variables were investigated using procedures from the Statistical Analysis System (SAS) program package (Barr, Goodnight, Blair, & Chilko, 1979). Bar

graphs and correlations helped clarify the relationships among the variables (see Appendix G). The univariate procedure was used to determine if the characteristics of the samples in Section One and Section Two were normally distributed. Again, a major limitation was the use of small and unbalanced samples.

As indicated in Table 1, for the first seven hypotheses a regression analysis of the data was done using the General Linear Models (GLM) procedure in the Statistical Analysis System (SAS) program package. In most cases this allowed for the use of the pretest reading score as a covariate. In addition to being the best predictor of posttest scores, the pretest was the ideal measure for including the influence of history, training, and native ability in one measure. Though it would be influenced by the learning disability and selective attention, using the pretest as a covariate with the posttest as a dependent variable was chosen as the best way of representing academic reading performance.

For hypotheses 8, 9, and 10, Pearson product-moment correlations were chosen for evaluating the comparisons. The scores on the instruments were continuous, ratio type measures. Because of the rating scale (Appendix C), hypothesis 11 was analyzed using Spearman rank-order correlations.

Subjects

The selective attention testing was done with volunteer teachers, so there was a definite teacher bias. However, testing was done with all their LD students, so the student sample was not biased. Testing

of the SIMS students was completed in the spring term of 1981. All the students in the SIMS program were eligible for, and participating in, the Learning Disability Program in the Marion County, Florida, public schools. All these students met the LD criteria of Marion County (Appendix A). Modality information and recent SIMS reading performance were obtained on the entire population of the LD program in Marion County, Florida. Only data from those classes undergoing the selective attention testing were actually used.

The VAKT program LD subjects were an entire LD class in Brevard County, Florida. The LD criteria were the same (Appendix A). The non-learning disabled subjects were referrals to that LD class from the total school. They were tested and not staffed into the LD program. Therefore they constituted an excellent comparison group since teachers considered their behavior similar to that of LD students but they were found not to have met the eligibility criteria.

Setting

The Marion County Public School System is located in the central part of Florida. It is a rapidly growing area of approximately 100,000 people. A large proportion of the population is in rural areas. The socioeconomic level of this sample ranges from low to upper middle class. The Brevard school is in a middle to upper class residential beach area.

Instrumentation

Introduction

This study attempted to maximize its implications for LD students by using three instruments widely used in LD programs. Thurlow and Ysseldyke (1979) studied the Child Service Demonstration Center LD models. They found that only five assessment devices were used by over half of the centers. This study used two of these widely used measures, the Wide Range Achievement Test (WRAT) used by 59.0% (Jastak & Jastak, 1978), and the Peabody Individual Achievement Test (PIAT) used by 53.8% (Dunn & Markwardt, 1970).

The Wide Range Achievement Test

Description. The Wide Range Achievement Test (WRAT) (Jastak & Jastak, 1978) had norms from age 5-0 to 11-11 for Level I. It featured three subtests and took between 20 and 30 minutes to administer. The reading test was administered individually. It required supplying the subject with the list of words and asking that they be pronounced aloud. In Level I, a pre-reading task, a vestibule test, was administered when there were failures in the first line of the reading test. The student then named 13 letters presented, matched 10 letters, and named the first two letters of his name.

The WRAT manual (Jastak & Jastak, 1978) described the normative population. All ethnic groups were included in the norms as they occurred in the population at large. In Level I the number of subjects in each population, i.e., 14 age groups at half year intervals from 5-0 to 11-6, ranged from 400 to 600. No attempt was made to obtain a representative

national sampling. Thurlow and Ysseldyke (1968) did a comparison of the 1976 and 1978 normative data. They found that standard scores on the two editions of the WRAT were closely comparable. Merwin (1972) criticized the ambiguity in the identity and nature of the groups.

Validity and reliability. Validity and reliability information in the manual (Jastak & Jastak, 1978) involved several editions because all editions of the WRAT were based on identical test items. Standard scores and percentiles were comparable for all editions, though the 1978 edition featured changes in the scaling techniques for the WRAT norms. Previous editions used a scaling of arbitrarily assigned grade ratings. In the 1978 edition, the raw scores were scaled.

Split-half correlation coefficients were $r = .98$ for Level I. Correlation coefficients between the two forms (Level I and II) yielded correlations between .94 and .88. The authors reported from "clinical experience" that the coefficients varied from .90 and .95. In studying unique variance of the WRAT subtests with the WAIS and WISC, the authors decided unique variance represented unreliability and thus developed reliability coefficients for reading from .92 to .97.

Thurlow and Ysseldyke (1979) rated reliability as technically adequate. Merwin (1972) referred to these as "questionably high reliability coefficients" (p. 64). Thorndike (1972) referred to the "startling" split-half reliability and suggested this was influenced by the test being timed and by the reading test being stopped after a specified number of failures.

The manual's estimates of validity cited a study by Wagner where WRAT levels and mid-term grades correlated +.88 (Jastak & Jastak, 1978). They also supported the observation that raw score performance reflected growth factors since at no time did an older school group obtain a smaller raw score than an earlier group.

Thurlow and Ysseldyke (1979) rated the validity of the WRAT as technically inadequate, based on the manual's report. Merwin (1972) questioned the degree to which these test tasks measured "achievement." Thorndike (1972) complained that content validity was not even considered and questioned whether the vestibule tests were measuring the same attribute as the body of the test. He characterized the validity information as containing "bizarre conceptions, and...somewhat exotic procedures" (p. 68). Thorndike (1972) and Merwin (1972) both ended suggesting the WRAT as primarily a clinical or research tool for a quick estimate of general level of ability and educational background.

The Peabody Individual Achievement Test

Description. The Peabody Individual Achievement Test (PIAT) (Dunn & Markwardt, 1970) was an individually administered achievement measure. The norms were based on 13 levels (K-12). It featured five subtests: mathematics, reading recognition, reading comprehension, spelling, and general information. It was an untimed power test (30 to 40 minutes). The reading recognition subtest had 84 items. Items 1 to 9 involved matching letters. Items 10 to 18 presented letters to be named. Items 19 to 84 were words which the subject read aloud.

The PIAT manual (Dunn & Markwardt, 1970) reported that the national test standardization sample used the same distribution as the population for geography and type of community (urban, suburban, rural, etc.). It had approximately 200 subjects in each of the 13 grade levels. Ages ranged from 5 to 12. Thurlow and Ysseldyke (1979) performed a factor analysis on the data from the standardization sample. For younger grades both of the reading subtests and the spelling subtest formed one factor, a verbal comprehension and reasoning factor. For higher grades, this factor included the mathematics, general information, and reading comprehension subtests, while reading recognition and spelling formed a separate factor.

There were a few general criticisms of the test. Bannatyne (1974) called the PIAT a "high quality" test and restricted his criticisms to the spelling score. He lamented the lack of a rate of reading measure and the lack of a frustration reading level measure. Proger (1970) found a few general criticisms. He requested more directions specific to special populations, i.e., particularly testing time, decried the "denigration of professionalism" (p. 464), i.e., the manual stated that professional experience was not needed for administering the PIAT, and worried over aspects of the basal-ceiling procedures. French (1972) also commented negatively on using paraprofessional administrators. Lyman (1972) complained about the smaller standardization samples and fewer subtests than group tests. Silverstein (1981) and Reynolds and Gutkin (1980) complained of the practice suggested in the manual of

comparing raw scores on pairs of subtests. They advocated comparing the standard score on each subtest to the mean of the standard scores on all tests, and both articles offered tables of differences required for significance.

Validity and reliability. The manual reported reliability based on Pearson product-moment correlations (Dunn & Markwardt, 1970). Samples of from 50 to 75 subjects at kindergarten, first, third, fifth, eighth, and twelfth grade levels were tested at one month intervals, then correlations were calculated on raw scores. Reliability coefficients varied from .42 for kindergarten subjects in spelling to .94 for third grade subjects in reading recognition. For the reading recognition subtest, 60 students in first grade had a reliability coefficient of .89 and 54 students in third grade had a reliability coefficient of .94. Finally, 51 students in the fifth grade had a reliability coefficient of .89. The standard error of measurement describing the expected bands of error for these test scores in reading recognition were 1.74 for grade one, 2.21 for grade three, and 3.90 for grade five. Lyman (1972) offered one of the few related criticisms when he complained that the test had lower test-retest reliability coefficients than group achievement tests.

The PIAT manual focused on two aspects of validity, i.e., item (content) validity and concurrent validity (Dunn & Markwardt, 1970). Content validity was developed by reducing 300 items per subtest to 84 items using item discrimination and difficulty indices.

Proger (1970) characterized this content validity as "sound enough" (p. 466) but decried the lack of evidence for construct validity and for predictive validity. Lyman (1972) made a similar point in asserting that more research was needed before establishing the PIAT as a "valid test" (p. 35).

Concurrent validity was the primary validity evidence in the manual and the literature. The manual (Dunn & Markwardt, 1970) reported a correlation with the Peabody Picture Vocabulary Test (PPVT) based on testing the same subjects used for retesting for reliability data. The overall median correlation was .57. The authors pointed out that the PPVT generally correlated with achievement tests in the .50s. Most concurrent validity studies with achievement tests compared the PIAT to the other individual achievement test, the WRAT.

Comparison of the WRAT and PIAT

PIAT subtests differed from the WRAT subtests in both content and approach, except for reading recognition. The PIAT manual (Dunn & Markwardt, 1970) stated that "correlation with the WRAT cannot be considered completely appropriate or pertinent evidence on the validity of the PIAT" (p.51). Yet these were the two individually administered, multiple subtest achievement tests available.

Several studies comparing the PIAT to the WRAT were summarized in Table 2. The study by Sitlington (cited in Dunn & Markwardt, 1970) used educable mentally retarded (EMR) adolescents (see Table 1). The study by Soethe (1972) used normal students (13), reading disabled students (12), and mentally retarded (MR) students (15). Wetter and French (1973) used 23 male and 7 female learning disabled pediatric outpatients (see Table 2).

Table 2

WRAT and PIAT Correlations

Study	Subjects	WRAT Rdg. PIAT Rdg.Recog.	Rdg. Rdg.Comp.	Arith. Math	Spell. Spell
A. Sitlington (Dunn & Markwardt, 1970)	46EMH	.95	.90	.58	.85
B. Soethe (1972)	40 mixed				
	Rdg.Disabled:	.92	.81	.37	.66
	MR:	.87	.76	.44	.65
	Normal:	.83	.95	.75	.82
C. Wetter & French (1973)	30 LD	.96	.85	.79	.86
D. Bray & Estes (1975)	45 LD	.9	.78	.76	.74
E. Baum (1975)	100 LD (by ages)				
	7-8 yr.:	.85	.72	.77	.62
	9 yr.:	.87	.62	.79	.71
	10 yr.:	.89	.56	.65	.62
	11 yr.:	.87	.90	.49	.61
F. Harmer & Williams (1978)	62-66 LD	.87	/	.64	.73
G. Scull & Brand (1980)	49 LD	.90	/	.83	.83

Bray and Estes (1975) also used a group test, the California Achievement Test (CAT), and teacher ratings of students' functional academic levels. The WRAT reading correlated .81 with CAT vocabulary, .72 with CAT comprehension, and .83 with CAT total reading. The WRAT correlated .90 with teacher ratings of both reading recognition and comprehension. The PIAT reading recognition correlated .84 with CAT vocabulary, .65 with CAT comprehension, and .81 with CAT total reading. The PIAT correlated .85 with teacher ratings of reading recognition and .87 with teacher ratings of reading comprehension. The WRAT and PIAT comparisons were summarized in Table 2.

Baum (1975) used 25 subjects from each of 4 age groups of subjects from self-contained LD classes (see Table 2). Harmer and Williams (1978) used students from a learning disabilities center (see Table 2). They used 62 subjects for the spelling comparison and 66 subjects for the word recognition and math subtests. In their discussion, they presented a few examples of students who had dramatically different scores on the math subtests. They discussed how the differences in test content, testing procedures, test format, and method of scoring accounted for these differences. However, Scull & Brand (1980) pointed out that these differences only reflected the population's interaction with the test, and that many subjects in the sample were only experiencing mild learning disabilities. In their own study Scull and Brand (1980) used severely learning disabled students. Both tests were administered on admission to a treatment center and again, two years later. They reported correlations for both original and follow-up testing (see Table 2).

The Detroit Tests of Learning Aptitude

Descriptions. The process tests for this study are from the Detroit Tests of Learning Aptitude (DTLA) (Baker & Leland, 1967) which is a collection of 19 subtests. It has been widely used by LD teachers. Thurlow and Ysseldyke (1979) reported that 20% of the model centers used this instrument, and 75% of these used it for placement and instructional programming, with 62% using it for pupil evaluation and 25% using it for program evaluation. Olson, Mercer, and Paulson (1981) reported that in many states teachers and diagnosticians were currently using the DTLA to evaluate process disorders, even when it was not required in the criteria for learning disability identification.

There are several limitations to the DTLA. Because of its limited standardization sample, age of the norms, and lack of adequate reliability and validity information, this research study used the DTLA only as a research instrument for estimating the relative performance of the students in auditory versus visual tasks. The tasks, particularly the auditory attention span (subtest no. 13) for related syllables and the visual attention span for objects (subtest no. 9), were similar to visual and auditory techniques used in research for attention and memory estimation. The DTLA was used in this study to make a very general distinction among subjects.

The subtests available were as follows: (1) pictorial absurdities, (2) verbal absurdities, (3) pictorial opposites, (4) verbal opposites, (5) motor speed and precision, (6) auditory attention span for unrelated words, (7) oral commissions, (8) social adjustment

A, (9) visual attention span for objects, (10) orientation, (11) free association, (12) memory for designs, (13) auditory attention span for related syllables, (14) number ability, (15) social adjustment B, (16) visual attention span for letters, (17) disarranged pictures, (18) oral directions, and (19) likenesses and differences. The authors suggested that there were eight psychological functions that explained these tests.

The DTLA manual (Baker & Leland, 1967) reported that the standardization initially involved 50, and later 150 students at every age level from 3 years to 19 years by 3 month intervals. The initial 50 students ranged in IQ from 90 to 110 as measured by group intelligence exams that were not specified. The initial standardization data were developed in 1935. The current norms were developed in 1955 (Buros, 1972). All the norm population were students examined in the Psychological Clinic of the Detroit Public Schools.

Validity and reliability. Test reliability was reported in the manual on 48 cases over a five month interval to be .959 (Baker & Leland, 1967). Another group of 792 pupils retested over a two or three year interval had a correlation of .675. For this group of mentally retarded, delinquent, and emotionally unstable children, the median IQ (multiplied by 100) from the DTLA remained almost the same, 70 to 71, and the standard deviation remained at eight IQ points. The manual also provided information that the correlations between 16 subtests on 100 children ranged from .2 to .4 (Baker & Leland, 1967).

The DTLA manual was basically oriented toward computing an IQ score. This score was inadequate compared to the Wechsler Intelligence Scale for Children--Revised (WISC-R) and other similar intelligence tests as well as unrelated to the main usefulness of the DTLA in LD programs. Silverstein (1978) made the most appropriate criticism by saying that considering the lack of appropriate reliability and validity after 40 years, one "would think that the situation might have been remedied long before this" (p. 303). Studies have compared the DTLA to various intelligence tests (Chiappone, 1968; Sandstedt, 1964) and to achievement tests (Olson et al., 1981), but the major emphasis here was on whether the DTLA represented a modality or process pattern with direct implications for teaching effectiveness.

Chiappone (1968) used the DTLA with educationally mentally retarded (EMH) students to examine correlations with the Binet Intelligence Test and the Wechsler Intelligence Scale for Children (WISC). No significant differences were found between the DTLA and Binet means or the Binet and WISC means, but the DTLA was significantly different from three WISC subtests. This showed the DTLA related closely to the verbal material of both tests, but not as closely to the performance content of the WISC.

Sandstedt (1964) studied the relationship between a "memory span test battery" from the DTLA and the WISC. Her subjects were 45 retarded readers of average general mental ability. The test battery from the DTLA included 5 subtests: auditory attention span for unrelated words

(No. 6), visual attention span for unrelated objects (No. 9), auditory attention span for related syllables (No. 13), visual attention span for letters (No. 16), and oral directions (No. 18).

Sandstedt (1964) found a significant difference for the retarded readers between their lower performance on the auditory memory span test of unrelated words and the visual test of unrelated objects. The correlation between the Detroit total memory span, IQ, and the WISC full scale IQ was .69. WISC performance scores were more closely related to total memory span (.66) than were the WISC verbal scores (.58). The auditory test for unrelated words correlated closer than the total auditory memory span. This study thus supported the contention that the DTLA really supplies supplementary information on intellectual aptitude. The relation between the DTLA and academic performance had been a major research concern as part of the overall effort to study the relations between modality or process tests and academic achievement reviewed in Chapter II.

Hagen's Central Incidental Attention Task

Unlike the previous tests, Hagen's Central Incidental Attention Task (Mercer, 1975) was not commonly used in LD programs. Despite its limitations, this instrument was chosen because of its frequent use in the research literature on selective attention in LD students. It should be pointed out that the Central Incidental Attention Task is primarily a research instrument. As such, there were no norms for the test, nor is there validity, or reliability data available. However, the research literature utilizing this instrument was often used for comparison and for providing information on construct validity.

The task could not be readministered because once the incidental matching was tested, the student no longer "ignored" these stimuli. Consequently, stability and reliability could not be measured. Another question concerned the selective attention index of efficiency measure (%C - %I). It was often used and occasionally produced some interesting correlations with other measures. Though it appeared to be most directly related to the filter theory model where successful selective attention involves filtering out incidental information, the data had clearly shown this model to be too simplistic. A detailed explanation for the continued use of this designation has not been offered. Hallahan (Note 2) suggested this was a practical measure from the definition of selective attention. Another measure was the total combined score of both tasks (C + I), which reflected the influence of both tasks on each other. This technique was suggested by Mercer (Note 7).

Description. The central task consisted of six 3 x 6 inch stimulus cards with black line drawings of a household object on the top half and an animal on the bottom half. Though the drawings were of somewhat poor quality, the same pictures (Mercer, 1975) were used in this study. Pictures of the deer, dog, and camel were used in the practice trial so that the subject would be familiar with them. The incidental task consisted of a 22 x 6 inch piece of cardboard displaying the six animals and pictures of the six objects. One modification for this study was that sufficient cards were printed to allow separate packets of the stimulus cards for each trial. This decreased the time required for administration.

Development. One of the earlier tasks that led to developing this instrument was a series of picture cards with distinctively colored backgrounds (Maccoby & Hagen, 1965). After a brief exposure, a cue card with the same color as the background of one of the picture cards was presented to the subject to match to the covered presentation card. The incidental learning task consisted of matching a set of solid color cards to a set of the pictures without the background color. Later the stimuli were changed to cards with objects and animals paired on each (Hagen & Kail, 1975). Hallahan, Gajar, Cohen, and Tarver (1978) further modified Hagen's task for use as a group selective attention measure. Hallahan, Tarver, Kauffman, and Graybeal (1978) made a more complicated version of Hagen's task to allow repeated tests. Three classes of stimuli were used, i.e., animals, household objects, and geometric figures.

Reference groups. There have been several studies outlining the general performance trends of normal subjects of various ages (Hagen & Kail, 1975; Maccoby & Hagen, 1965). The effort has begun, with small samples, to outline the general pattern of performance for various ages of LD subjects (Tarver, Hallahan, Cohen & Kauffman, 1977).

Procedures. The procedure used for Hagen's Central Incidental Attention Task began with oral directions to the student: "I will be showing you some cards. Pay attention to the animal. I will ask you to point to the correct animal after I show you several cards."

Next the subject was given two practice trials using three stimulus cards. The examiner showed them to the student, placed them face down, and then asked the student to point to the camel. This procedure was then repeated, but the student was asked to point to the dog.

For the central task, the experimenter presented each 3 x 6 stimulus card face up for two seconds, then placed it face down in front of the subject in a manner which proceeded from the subject's left to right. After the last card for each trial, the cue card identical to one of the trial cards was presented. The subject tried to select the matching card. On the data sheet, the examiner indicated under central task response whether the student was correct (+) or not (-). The number of successful trials was the central task score. There were 12 trials of 3 to 6 cards in length (see Appendix B).

Hagen's incidental task immediately followed the central task, trial 12. It <u>only</u> followed the last central task. The student was presented the 22 x 6 inch piece of cardboard with the six animals pictured. Next, the student took picture cards (3 x 3 inch) of the six household objects and matched the household object (incidental stimulus) with the animal picture (central stimulus). The incidental score was obtained by recording the number of correct pairings at the bottom of the data sheet. The combined selective attention measure was obtained by adding the incidental and central scores (C + I). The selective attention efficiency measure (%C - %I) or index score was obtained for each subject by subtracting the proportion of correct incidental scores from the proportion of correct central scores.

CHAPTER IV

ANALYSIS AND RESULTS

The purpose of this reserach was to investigate the importance of visual selective attention to learning disabled students' reading performance. The results are divided into three sections corresponding to those described in Chapter III. The first section reports the comparison of the influence of selective attention on student performance in different reading programs. The second section reports the performance of students with different levels of selective attention in the SIMS precision taught reading program. The final section describes the examination of the instrument, Hagen's Central Incidental Attention Task (Hagen & Kail, 1975; Mercer, 1975).

Section One

Subject Characteristics

This section involved comparing 19 learning disabled (LD) students in the Systematic Instructional Management Strategies (SIMS) reading program in Marion County, 20 learning disabled students in a Visual-Auditory-Tactile-Kinesthetic (VAKT) type reading program in Brevard County, and 11 non-learning disabled students referred for testing but not staffed into the Brevard learning disability program. The difference in counties confounded the program variable. Additionally, due to their small numbers and severe attrition, the non-learning disabled students were later omitted from further analysis.

Examinations of student characteristics were performed using the univariate procedure in the Statistical Analysis System (SAS) program package (Barr, Goodnight, & Sall, 1979) to determine the characteristics of the samples. The mean values for three groups on CA, IQ, and pretest are presented in Table 3. The distributions of chronological age, intelligence quotients, and pretest scores for the groups are shown in the histograms in Appendix G.

Table 3

Means and Standard Deviations of Chronological Age (CA), Intelligence Quotient (IQ), PIAT Reading Recognition Pretest, PIAT Reading Comprehension Pretest

		CA		IQ		Pretest Reading Rec.		Pretest Reading Comp.	
Group	Number	Mean	SD	Mean	SD	Mean	SD	Mean	SD
SIMS Prog.	N = 19	8.75	1.32	96.2	11.52	1.81	.827	1.83	1.25
VAKT Prog.	N = 23	8.77	1.39	103.0	13.69	3.50	1.17	3.91	1.30
Non-LD	N = 11	9.10	.59	109.0	14.17	*4.41	1.47	*4.80	1.56

*Pretest-Posttest scores were only available for 6 of 11

Table 4 presents the results of the univariate procedure explained in Chapter III. The study of LD students required that reading achievement scores would not be normally distributed. These subjects constituted a sample having scores below a cut-off of the whole population of reading students. The distribution would therefore be positively skewed, beginning at the point wherever the limits (%EA) for serious deficiencies were defined, in the most dense part of the distribution. Table 4 reveals that only the SIMS program students showed this pattern.

Table 4

The Shapiro-Wilk W-Statistic and Skewness Statistic for the Data Values as a Random Sample from a Normal Distribution

W: Normal Statistic
P: Probability
SK: Skewness

Group	Number		CA	IQ	PIAT Pretest Reading Recog.	Comp.
SIMS Prog.	N = 19	W:	.962	.949	.858	.845
		P :	.61	.42	.01*	.01*
		SK:	-.40	.02	1.43	-.53
VAKT Prog.	N = 20	W:	.949	.962	.983	.943
		P :	.39	.57	.95	.42
		SK:	.40	-.43	-.27	-.39
Non-LD	N = 11/6	W:	.891	.877	.940	.821
		P :	.19	.15	.61	.09
		SK:	-1.37	-.59	.14	1.41

*p < .05

The small sample sizes available imposed limitations on statistics. The three groups differed on intelligence and reading. The means revealed that the non-LD group had the highest scores and the SIMS program group had the lowest scores. The VAKT group's scores were higher than the SIMS program group's scores in IQ and achievement. This made their comparison difficult, but the use of a covariate technique helped correct for some of this difference. Likewise, subject characteristics such as chronological age (CA) and intelligence scores (IQ) had essentially normal distributions even though the samples were small. However, the students in the SIMS program had pretest PIAT reading recognition and pretest PIAT comprehension scores that were not normally distributed.

Hypothesis 1

Hypothesis 1 assumed that because precision teaching improves attending it thus will alleviate selective attention's effect on reading performance. Therefore a VAKT taught LD group's reading scores will be most influenced by selective attention, a precision taught (SIMS) LD group's reading scores will be less influenced, and a non-LD group's reading scores will be the least influenced by the students' selective attention levels. A regression analysis of the data was done using the General Linear Models procedure (GLM) in the Statistical Analysis System (SAS) program package. The three reading treatment groups (Table 5) were later reduced to two, SIMS and VAKT groups, to better balance the sample size (Table 6). It was believed that the following model would best describe the relationships expected:

$$Y = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_2X_3 + e$$

Y = Reading Posttest Achievement Score

X_1 = Reading Pretest Achievement Score

X_2 = Selective Attention Group

Level 1 = with C score > = 6, and %C - %I > 8;

Level 2 = all others

X_3 = Membership in treatment group

SIMS program, VAKT program, or regular basal program

(or later just the first two groups)

$B_4X_2X_3$ = the interaction term for selective attention vs. membership in treatment group

There was a strong relationship between model 1 and the dependent variable due to the covariate. There was a significant relationship between the three groups and PIAT reading recognition (R^2 = .87) and reading comprehension (R^2 = .70), and between the two groups (VAKT and SIMS) and reading recognition (R^2 = .85) and reading comprehension (R^2 = .64). The results of the regressions for all three reading treatment groups are given in Table 5. The results for just the LD students in the SIMS program and the VAKT program are presented in Table 6.

Table 5

Results of the Statistical Test for the Analysis of Hypothesis 1: Three Groups

Reading Recognition as Y and X_1

Source	df	SS	F	P>F
Pretest X_1	1	37.81	112.11	.0001*
SA X_2	1	.40	1.18	.28
Rdg. Groups X_3	2	.57	.84	.43
Interaction X_2X_3	2	.29	.43	.65
Error	38	12.81		
Total	44	100.48		

Reading Comprehension as Y and X_1

Source	df	SS	F	P>F
Pretest X_1	1	43.69	24.55	.0001*
SA X_2	1	.17	.09	.76
Rdg. Groups X_3	2	2.20	.62	.54
Interaction X_2X_3	2	7.76	2.18	.13
Error	33	58.73		
Total	39	198.85		

*$p < .05$

Using PIAT reading recognition (Y) as the dependent variable, the F value observed for testing for the interaction of selective attention, X_2, and the three reading methods used, X_3, was $F = .43$. The probability of obtaining that value when assuming a null hypothesis was .65. Thus, there was not enough evidence to conclude that such an interaction was present. The F value observed for testing for the main effect of the selective attention group, high or low, was 1.18, yielding a probability of obtaining that value, assuming a null hypothesis of .28. Once more, there was not enough evidence to conclude that an effect was present.

Using PIAT reading comprehension as the dependent variable, the results were essentially the same. They lacked any evidence to conclude that an effect was present.

Table 6

Results of the Statistical Test for the Analysis of Hypothesis 1: Two Groups**

Reading Recognition As Y and X_1

Source	df	SS	F	P>F
Pretest X_1	1	30.18	84.99	.0001*
SA X_2	1	.05	.14	.71
Rdg. Group X_3	1	.62	1.74	.20
Interaction X_2X_3	1	.03	.08	.78
Error	34	12.07		
Total	38	78.87		

Reading Comprehension As Y and X_1

Source	df	SS	F	P>F
Pretest X_1	1	24.44	13.49	.001*
SA X_2	1	4.12	2.28	.14
Rdg. Group X_3	1	2.96	1.64	.21
Interaction X_2X_3	1	7.23	3.99	.06
Error	29	52.51		
Total	33	145.59		

*$p < .05$
** SIMS and VAKT programs

As shown in Table 6, the F value for the interaction was .08, using Y = PIAT reading recognition score. The probability of obtaining this value, assuming a null hypothesis, was .78. Thus there was not evidence to conclude that this interaction was present. The F value observed for testing for the main effect of the selective attention group (high or low) was .14, yielding a probability of .71. Once more there was insufficient evidence to conclude that an effect was present.

Using the PIAT reading comprehension as the dependent variable (Y), the results were essentially the same. There was a lack of significance in the tests for the interaction and for the main effect, selective attention group (X_2).

Hypothesis 2

Hypothesis 2 stated that selective attention will relate to reading performance. Low visual selective attention performance will be related to low reading achievement when measured by the total task performance measure (C + I) more strongly than when measured by the percentage selective attention measure (%C - %I). This last measure had often been used as an indication of selective attention efficiency (Tarver, Hallahan, Kauffman, & Ball, 1976). A regression analysis of the data to investigate Hypothesis 2 was done using the General Linear Models (GLM) procedure in the Statistical Analysis System (SAS) program package. The model best describing this was still model 1 with X_2 = selective attention changing from the categorical group membership of hypothesis one to the continuous measures, combined capacity (C + I)

or efficiency (%C - %I). Again the model containing the covariate explained a significant amount of the variance of Y, with $R^2 = .88$ for reading recognition and $R^2 = .60$ for reading comprehension. The F ratio statistic was used to evaluate hypothesis 2. The results when defining selective attention as the total capacity under distraction (C + I) are presented in Table 7. The results when using selective attention as the efficiency index (%C - %I) are presented in Table 8.

Table 7

Results of the Statistical Test for the Analysis of Hypothesis 2: Selective Attention as Total Capacity (C + I) With Two Groups**

Y_A = Reading Recognition

Source	df	SS	F	P>F
Pretest X_1	1	27.16	97.17	.0001*
SA Total X_2	1	2.54	9.09	.005*
**Rdg. Group X_3	1	1.81	6.50	.02*
Interaction X_2X_3	1	1.17	4.21	.05*
Error	34	9.50		
Total	38	78.87		

Y_B = Reading Comprehension

Source	df	SS	F	P>F
Pretest X_1	1	30.85	41.05	.0005*
SA Total X_2	1	.00	.00	.99
**Rdg. Group X_3	1	1.85	.93	.34
Interaction X_2X_3	1	3.78	1.90	.18
Error	29	57.82		
Total	33	145.59		

*$p < .05$
**SIMS and VAKT groups

Using PIAT reading recognition as the dependent variable, the F value observed for testing for the interaction of selective attention, defined as total capacity (C + I), with the two LD reading groups was 4.21. This meant that, assuming a null hypothesis, the probability of observing data that would yield an F value of 4.21 was .05. This led to the conclusion that there was evidence that a relationship did exist between Y, PIAT reading recognition, and the interaction, since it was improbable that this F ratio occurred only by chance. The data also yielded an F value of 6.50 for the effect of the reading groups, with a corresponding P value of .02. This was significant at the .05 level. The F value for the main effect of the continuous capacity measure of selective attention (C + I) was 9.09. This had a corresponding P value showing it was significant at the .05 level. This led to the conclusion that a relationship did exist between selective attention, measured as total capacity, and reading performance, since it was improbable that the observed F ratio occurred only by chance. However, because the VAKT group's means were higher in IQ, pretest and posttest measures, and combined selective attention (C + I), the results may be emphasizing the difference between the groups.

Using the PIAT reading comprehension scores as the dependent variable (Y), the F value for the interaction was F = 1.90, with a corresponding probability of .17. There was not enough evidence to conclude that this interaction was present. For selective attention capacity (C + I), the F value for the main effect was .35. The corresponding probability of obtaining that value of F was .56. Thus,

there was not enough evidence to conclude that an effect was present. The results using the selective attention efficiency measure (%C - %I) are reported in Table 8. Again model 1 containing the covariate explained a significant amount of the variance of Y, with $R^2 = .85$ for reading recognition and $R^2 = .57$ for reading comprehension.

Table 8

Results of the Statistical Test for the Analysis of Hypothesis 2: Selective Attention as Efficiency Measure (%C - %I) With Two Groups**

Y_A = Reading Recognition

Source	df	SS	F	P>F
Pretest X_1	1	32.24	95.67	.0001*
SA % X_2	1	.48	1.42	.24
**Rdg. Group X_3	1	.32	.96	.33
Interaction	1	.27	.83	.37
Error	34	11.45		
Total	38	78.87		

Y_B = Reading Comprehension

Source	df	SS	F	P>F
Pretest X_1	1	39.98	18.53	.0001*
SA % X_2	1	.11	.05	.81
**Rdg. Group X_3	1	1.00	.47	.50
Interaction	1	.16	.07	.79
Error	29	2.56		
Total	33	145.59		

*$p < .05$
**VAKT and SIMS Programs

Using PIAT reading recognition as the dependent variable, the F value of the interaction yielded a probability of obtaining that value of .37. Consequently there was not enough evidence to conclude that an interaction was present. In testing the main effect, selective attention efficiency, the data yielded an F value of 1.42 which had a corresponding P value of .24. Again, there was not enough evidence to conclude that an effect was present.

Using PIAT reading comprehension as the dependent variable, the F value of .07 for the interaction of selective attention efficiency (%C - %I) and the reading programs (SIMS or VAKT) yielded a probability of obtaining that value by chance of .79. Thus there was insufficient evidence to conclude that such an interaction was present. The F value observed for testing the main effect, selective attention efficiency (%C - %I), was F = .05, corresponding to a probability of .81. Thus there was no evidence to conclude that an effect was present.

Table 9 presents the means for these groups on the posttests and selective attention measure to show the magnitude and direction of these effects. Gain scores are also included to facilitate comparisons.

Table 9

Group Means for PIAT Reading Recognition Posttest,
PIAT Reading Comprehension Posttest and Selective Attention

Group	N	Reading Recog.	N	Reading Comp.	N	Scores Rd.Rec.	N	Scores Rd.Rec.	Selective Attention %C-%I	Selective Attention C + I
SIMS Prog.	19	2.63 SD .88	18	2.82 SD .98	19	.82 SD .69	18	.99 SD 1.01	16.26 SD 32.51	8.74 SD 2.21
VAKT Prog.	20	4.53 SD 1.26	16	5.06 SD 2.40	20	1.02 SD .46	16	1.16 SD 1.75	14.48 SD 37.22	9.40 SD 3.78
Basal, Non-LD	6	5.17 SD 1.33	6	6.20 SD 2.26	6	.75 SD .48	6	1.40 SD .93	52.18 SD 21.93	9.00 SD 1.90

All the group means showed improvement from the pretest to the posttest and the same order of magnitude prevailed, i.e., the non-LD basal reading was highest, the VAKT reading program was next, and the SIMS reading program was last. The gains scores in reading recognition were the only exception to this order. The VAKT program had greater gains than the SIMS program, which had greater gains than the non-LD basal reading program. Using the Shapiro-Wilk W-Statistic and skewness, the only exceptions from a normal distribution were the SIMS program's reading comprehension gains scores ($W = .848$, $P > .01$, $SK = 626$) and the VAKT program's reading comprehension ($W = .868$, $P > .02$, $SK = 1.70$).

Section Two

Subject Characteristics

Section Two investigated hypotheses three through seven. These required or benefited from using a large sample of LD students in the SIMS program ($N = 67$). This avoided the earlier problems of Section One caused by the effort to include different reading programs for comparisons. None of these subjects were used in Section One. Appendix G contains graphs of the distributions of their chronological age in Figure 9, the distribution of their IQ scores in Figure 10, and the distribution of their WRAT pretest scores in Figure 11.

Table 10 shows the results of the univariate procedure of the Statistical Analysis System (Barr, Goodnight, & Sall, 1979). Again, chronological age and IQ were normally distributed and, as expected, LD students' reading achievement was reminiscent of just the lower tail of a normal distribution of all students' reading scores.

Table 10

The Means, Kolmogorov-Smirnov D-Statistic, and Skewness Statistic for the LD Students in Section Two

	CA	IQ	WRAT Reading Pretest	WRAT Reading Gain Score
Means	9.14	97.3	2.70	.96
Standard Deviation	1.47	12.8	.96	.65
D-Test Statistic	.089	.109	.151	.151
Probability	.15	.05	.01*	.01*
Skewness	-.22	.32	.85	1.05

*$p < .05$

As explained in Chapter III, the subjects were divided into three groups described mathematically using central scores (C), incidental scores (I) or total scores (C + I) in the following ways:

1. Group one: poor selectors

   [low central ($C \leq 8$) and high total ($\text{Total} \geq 9$)]

2. Group two: subjects with overall poor performance

   [low central ($C \leq 8$) and low total ($\text{Total} < 9$)]

3. Group three: subjects with good selective attention scores

   [high central ($C > 8$) and low incidental ($I < 5$)]

Hypothesis 3

Hypothesis 3 stated that among three groups of LD students differing in selective attention, the most effective selective attention group will have the highest reading achievement score. The less effective

selective attention group with good attention/memory ability will have lower reading achievement scores, and the less effective attention group with poor attention/memory ability will have the lowest reading achievement score.

Table 11

Means of WRAT Reading Scores for Different Levels of Attention

Selective Attention Grouping	N	Pretest	Posttest	Gain Score
Group 1 - Poor S.A.	26	2.72	3.60	.88
Group 2 - Poor Perf.	24	2.42	3.30	.88
Group 3 - Good S.A.	17	3.21	4.41	1.21

The means in Table 11 showed that the results of the analysis found the subjects with the best selective attention performance also had the highest reading performance. The subjects with lower selective attention performance had identical gain scores. The memory/attention difference did show up in a slightly higher level for students higher in memory/attention, i.e., group one. The statistical analysis of hypothesis three used the General Linear Model (GLM) procedure of the Statistical Analysis System (SAS) program package (Barr, Goodnight, & Sall, 1979). The following model best described the relationships expected:

Regression Model 2

$$Y' = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_2X_3 + e$$

Y' = Posttest WRAT Reading Achievement scores

X_1 = Pretest WRAT Achievement scores

X_2 = Subject Age Group (4)

X_3 = Subject's Selective Attention Performance Group

X_2X_3 = Interaction (age group x selective attention)

There was a strong relationship between model 2 and the dependent variable ($R^2 = .82$). The results of the statistical test are presented in Table 12.

Table 12

Results of the Statistical Test for the Analysis of Hypothesis 3 (N = 67)

Source	df	SS	F	P>F
Main Effects Pretest	1	59.26	167.79	.0001*
Age	3	3.12	2.95	.04*
Selective Attention Group Level (SA)	2	1.20	1.70	.19
Interaction Age x SA	6	1.81	.86	.53
Error	54	19.07		

*$p < .05$

In Table 12 the F value for the interaction of age group (X_2) and selective attention group (X_3) was .86. The probability of obtaining

that value, assuming the null hypothesis, was .53. Thus there was not enough evidence to conclude that such an interaction was present.

The F value observed for the main effect of age group (X_2) was 2.95. With the continuous variable, pretest, as a covariate, age became significant at the .05 level.

The F value observed for the main effect of selective attention group (X_3) was 1.70. The probability of obtaining that value, assuming the null hypothesis, was .19. Thus there was not enough evidence to conclude that an effect was present.

Hypothesis 4

Hypothesis 4 stated that selective attention will relate to reading performance on the WRAT with low selective attention performance more closely related to low reading achievement when measured by combined selective attention (C + I), than when measured by the composite, selective attention efficiency measure (%C - %I). The regression model was as follows:

Regression Model 3

$$Y = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + e$$

Y = Posttest WRAT Reading Score

X_1 = Pretest WRAT Reading Score

X_2 = Selective Attention (SA): a continuous variable defined as total SA capacity (C + I) or as selective attention efficiency (%C - %I)

X_3 = Age

The results of the analysis for the F ratio appear in Tables 13 and 14. Model 3 showed a strong relationship with the dependent variable. Due to the covariate, there was a significant relationship between the model and posttest WRAT reading scores. This occurred using both combined selective attention (C + I) (R^2 = .75) and selective attention efficiency (R^2 = .75). Table 14 shows the results after eliminating the age effect and examining the interaction.

Table 13

Results of the Statistical Test for the Analysis of Hypothesis 4: Selective Attention as Total Capacity (C + I)

Source	df	SS	F	P>F
Pretest X_1	1	4.04	10.16	.002
Age	1	1.48	3.72	.06
SA Total X_2	1	.04	.12	.73
X_2X_3	1	.03	.07	.80
Error	64	26.16		
Total	66	104.83		

*$p < .05$

The F value observed for the main effect of the combined selective attention capacity measure (C + I) was F = .12, with the probability of obtaining that value as .73. Therefore there was not enough evidence to conclude that this effect was present.

Table 14

Results of the Statistical Test for the Analysis of Hypothesis 4: Selective Attention as Efficiency Measure (%C - %I)

Source	df	SS	F	P F
Pretest (X_1)	1	65.04	159.98	.0001*
SA (X_2)	1	.40	.97	.33
X_1X_2	1	.75	1.81	.18
Error	63	25.93		
Total	66	104.83		

*$p < .05$

In testing the main effect, selective attention efficiency (%C - %I), the data yielded an F value of .97 which had a corresponding P value of .33. Again, there was not enough evidence to conclude that an effect was present.

Table 15

Results of the Statistical Test for the Analysis of Hypothesis 4: Characteristics of Experimental and Sample Variables (N = 67)

	Pearson Product-Moment Correlations			
	C + I SA Total	SA %C - %I	Central	Incidental
CA	.37*	.30*	.46*	-.01
IQ	.14	.19	.21*	-.06
Pretest	.28*	.15	.31	.05
Posttest	.32*	.09	.31*	.13

	Means	Standard Deviations
SA Total	9.26	3.01
SA %C - %I	19.00	31.34

*$p < .05$

The results showed that the selective attention efficiency measure (%C - %I) had considerable variation (SD = 31.34). From these correlations it was obvious that the incidental measure was measuring something independent of most of the characteristics, including intelligence and memory. However, the central score, expected to be reflecting memory ability, indeed correlated significantly with all the characteristics. The results failed to support hypothesis four.

Hypothesis 5

Hypothesis 5 stated that the visual selective attention task will relate to modality test performance such that students low in visual

modality aptitude will score low on visual selective attention, resulting in a high correlation. In combination with hypothesis 6, this hypothesis also helped clarify how these two psychological constructs related to each other. The following model described the relationships:

Regression Model 4

$$Y = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_2X_3 + e$$

Y = Reading Achievement

X_1 = Pretest

X_2 = Selective Attention

X_3 = Modality Preference/Performance

X_2X_3 = Interaction of Modality Measure and Selective Attention Measure

Table 16

Results of the Statistical Test for the Analysis of Hypothesis 5: Selective Attention as Combined Capacity (C + I)

Source	df	SS	F	P>F
Pretest X_1	1	62.27	148.34	.0001*
Selective Attention X_2	1	.56	1.33	.25
Modality X_3	2	.12	.15	.86
Interaction X_2X_3	2	.23	.27	.76
Error	60	25.10		
Total	66	104.83		

*$p < .05$

Table 17

Results of the Statistical Test for the Analysis of Hypothesis 5: Selective Attention as Composite Efficiency Measure (%C - %I)

Source	df	SS	F	P>F
Pretest X_1	1	70.16	175.20	.0001*
Selective Attention X_2	1	1.23	3.08	.08
Modality X_3	2	2.05	2.57	.08
Interaction X_2X_3	2	1.15	1.44	.25
Error	60	24.03		
Total	66	104.83		

$^*p < .05$

Table 18

Results of the Statistical Test for the Analysis of Hypothesis 5: Selective Attention as Group Membership

Source	df	SS	F	P>F
Pretest X_1	1	67.85	173.81	.0001*
Selective Attention X_2	1	.00	.00	.98
Modality Preference X_3	2	2.62	3.36	.04*
Interaction X_2X_3	2	1.96	2.52	.08
Error	60	23.42		
Total	66	104.83		

$^*p < .05$

The results showed that hypothesis five was not supported. There was no significant interaction between selective attention, defined as combined capacity (C + I), as a composite efficiency measure (%C - %I), or as group membership and modality preference. The total capacity measure of selective attention (C + I) had a negative correlation to the modality preference rankings, the three categories defined in Chapter III. The lowest group (1) had the subjects with low visual modality scores. Modality preference did reveal a significant relationship (P = .04) to reading performance when selective attention was defined by group membership.

Hypothesis 6

Hypothesis 6 stated that the selective attention task theoretically measures an underlying LD characteristic. Therefore more of this variance will be explained by modality (DTLA) performance than by student IQ scores.

Table 19 presents the correlation matrix for the subject and experimental variables relating to modality preference and underlying LD characteristics. Tables 20 and 21 present the regression analysis of the following model:

$$Y = B_0 + B_1X_1 + B_2X_2 + B_3X_1X_2 + E$$

Y_2 = Selective Attention

X_1 = Modality preference main effect

X_2 = IQ Score main effect

X_1X_2 = Interaction of Modality Preference and IQ score

Table 19

Correlation of Modality Preference and Experimental and Subject Variables (N = 67)

	Modality	SA Total	% SA	IQ	CA	Pretests Score	Posttests Score	Gain Scores	SA Group
SA Total		1.00	.06	.14	.37**	.28**	.32	.21	.07
SA %			1.00	.20	.31*	.16	.09	-.06	.47**
IQ				1.00	-.30	.04	.20	.31	.12
CA					1.00	.48**	.34*	-.06	.12
Pretests						1.00	.86	.18	.16
Posttests							1.00	.65	.22
SA Group									1.00

*p < .05
**p < .01

Table 20

The Results of the Statistical Test for Hypothesis 6: Selective Attention as Combined Capacity (C + I)

Source	df	SS	F	P F
Modality Preference X_1	2	24.77	1.60	.21
IQ Score X_2	1	.17	.02	.88
Interaction X_1X_2	2	32.1	2.07	.13
Error	61	473.65		
Total	66	601.16		

*p < .05

Table 19

Correlation of Modality Preference and Experimental and Subject Variables (N = 67)

	Modality	SA Total	% SA	IQ	CA	Pretests Score	Posttests Score	Gain Scores	SA Group
Modality	1.00	-.37	-.17	-.24	-.14	-.25*	-.30**	-.21	-.01
SA Total		1.00	.06	.14	.37**	.28**	.32	.21	.07
SA %			1.00	.20	.31*	.16	.09	-.06	.47**
IQ				1.00	-.30	.04	.20	.31	.12
CA					1.00	.48**	.34*	-.06	.12
Pretests						1.00	.86	.18	.16
Posttests							1.00	.65	.22
SA Group									1.00

*p < .05
**p < .01

Table 20

The Results of the Statistical Test for Hypothesis 6: Selective Attention as Combined Capacity (C + I)

Source	df	SS	F	P>F
Modality Preference X_1	2	24.77	1.60	.21
IQ Score X_2	1	.17	.02	.88
Interaction X_1X_2	2	32.1	2.07	.13
Error	61	473.65		
Total	66	601.16		

*p < .05

Table 21

The Results of the Statistical Test for Hypothesis 6:
Selective Attention as Composite Efficiency Measure (%C - %I)

Source	df	SS	F	P>F
Modality Preference X_1	2	1111.88	.59	.55
IQ Score X_2	1	12.85	.01	.91
Interaction X_1X_2	2	713.94	.38	.68
Error	61	57081.92		
Total	66	64844.00		

*$p < .05$

Using the selective attention combined capacity score (C + I), the F value observed for testing for the main effect (B_1X_1) of modality preference group was 1.60, which had a corresponding P value of .21. Using the selective attention composite efficiency measure (%C - %I), the F value for testing for the main effect of modality preference group was .59, yielding a corresponding probability of .55. In both cases this led to concluding that a relationship did not exist between these selective attention measures and modality preference. The unique variance due to modality preference group was not significant in either group. Finally, the interaction was not significant. The analysis of the plot of the interaction with Y_2 = selective attention as combined capacity (C + I) yielded separate distributions for modality groups.

The diagram of this interaction was very interesting, though it was not significant. It showed lines, each made up of one modality preference level, going at different slopes. The line where increases in intelligence corresponded to increases in selective attention (C + I) was made up exclusively of group two, low scores in auditorily oriented subtests. Both group one and group three had lines where increases in intelligence corresponded to decreases in selective attention performance (see Figure 1). Group one, the group with low scores in visually oriented subtests only had five subjects. Group three was the group having low scores in both areas.

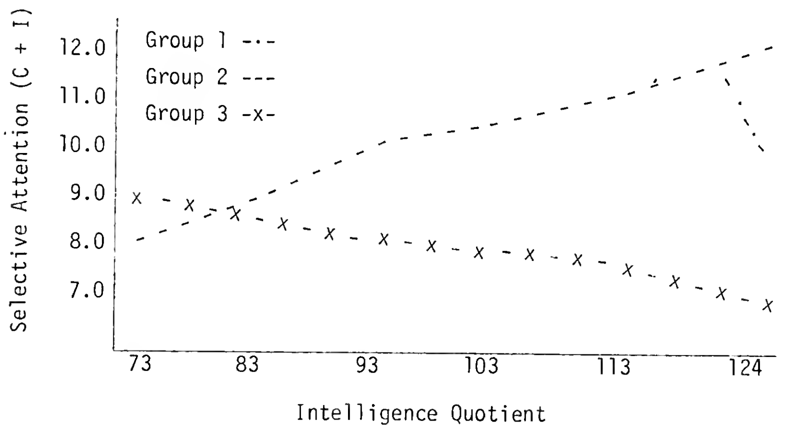


Figure 1

Plot of Combined Selective Attention (C + I) and Intelligence Interaction with Modality Preference Groups

The graph revealed a disordinal interaction, but not over the IQ range of primary concern (Kerlinger & Pedhazur, 1973). The relationship showed that subjects having low performances on tests of their visual processing modality, groups one and three, performed on the selective attention in opposition to their intellectual ability. That is, the higher their intelligence, the more likely they were to ignore or do more poorly on the selective attention task.

Hypothesis 7

Hypothesis 7 stated that differences between the students' LD teachers will influence their reading achievement scores more than the influence of the students' selective attention performance. Table 22 presents the regression analysis of that question with the following model:

$$Y = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_2X_3 + E$$

Y = WRAT Achievement Scores

X_1 = Pretest scores

X_2 = Selective attention - total capacity (C + I) or group membership

X_3 = Teacher category

X_2X_3 = Interaction

The amount of variance explained by the model was significant, yielding $R^2 = .83$ for selective attention combined capacity (C + I). These results are presented in Table 22. The model yielded $R^2 = .81$ for selective attention as group membership in one of the three groups defined in Chapter III. Results for this analysis are presented in Table 23.

Table 22

The Results of the Statistical Test for Hypothesis 7:
Selective Attention as Combined Capacity (C + I)

Source	df	SS	F	P>F
Pretest	1	77.92	209.57	.001*
Selective Attention	1	.31	.82	.37
Teacher	9	2.86	.96	.48
Interaction	8	3.24	1.09	.38
Error	47	17.48		
Total	66	104.83		

*p < .05

The F value observed for the testing for the interaction of selective attention as combined capacity (C + I) and the LD teacher was F = 1.09, with the probability of obtaining the value by chance being .38. Thus there was not enough evidence to conclude that such an interaction was present. The F value observed for the testing for the main effect of the teacher, after selective attention, was .96, with the probability of obtaining that value being .48. There was not enough evidence to conclude that the effect was present.

Table 23

The Results of the Statistical Test for Hypothesis 7: Selective Attention as Group Membership

Source	df	SS	F	P>F
Pretest X_1	1	52.40	126.33	.0001
Selective Attention X_2	1	.14	.34	.56
Teacher X_3	9	1.79	.62	.74
Interaction	7	.96	.33	.93
Error	48	19.91		
Total	66	104.83		

*p < .05

The F value for the interaction of selective attention as membership in one of the three groups and the LD teacher was F = .33, with a P value of .93. Thus there was no support for concluding that such an interaction was present. For the main effect, LD teacher, after entering of the selective attention group, the F value was F = .62, with a P value of .74. Again there was no support for concluding that the main effect was present. Thus hypothesis 7 was not supported.

Teacher Attitudes

The attitudes of all the learning disability teachers using the SIMS in Marion County towards the SIMS Program was assessed by a confidential questionnaire (see Appendix F). There was a 100% response rate from two mailings to all teachers. The responses were summarized as follows (N = 15):

1. The SIMS program was rated more effective than any other reading approach by 10 teachers, less effective by one, and "just like any other" by two.
2. The SIMS program was rated as taking the same effort to teach as other reading programs by seven teachers, taking more effort by four, and taking less effort by three.
3. All 15 indicated they would want to continue with the SIMS program if they had to decide that day.
4. When asked to rate the information from student scores on the Detroit (DTLA), six said it was necessary to teach students, four said it was useful for diagnosis but not teaching, and three said it was interesting but not necessary to teach students.
5. When asked if the SIMS program offered the teacher enough opportunity to teach the words any way they wished, 12 answered yes and one answered no.

Only those teachers who had participated in this study and were currently employed, completed this questionnaire again in April 1982 (Appendix F). During the interim the LD supervisor changed and some teachers reported much less emphasis on utilizing the SIMS program. Of 11 questionnaires, 7 were returned (64%). This time three rated the program more effective than any other reading approach, and three rated it "just like" other approaches, and one rated it less effective

than other approaches. However this same respondent indicated she would want to continue with the SIMS program. Four respondents indicated it took the same effort as other approaches, two indicated less effort, and one indicated more effort. All indicated they would want to continue with the SIMS program, and all indicated they had enough opportunity to teach the words any way they wished outside of the timings.

Section Three: Instrument Examinations

Hypothesis 8 Comparison to Other Selective Attention Measures

This part of the study compared Hagen's Central Incidental Selective Attention Task with other commonly used indexes of selective attention used by Argulewicz (1982). In addition to the WISC-R subtests and the Memory for Sentences Part II (MSII) of the Stanford-Binet Intelligence Scale used by Argulewicz, comparison was also made to Memory for Sentences Part III and a composite score of Part II and III. The subjects were 16 of the learning disabled students from the Brevard County VAKT group of Section One. The hypothesis and results follow.

Hypothesis 8 stated that scores obtained from Hagen's Central Incidental Attention Task will correlate significantly with other measures of selective attention. Table 24 shows these correlations.

Table 24

Correlations Between Hagen's Central Incidental Attention Task and Other Attentional Measures

SA Measure	No. Subjects	Central Score	Incidental Score	C + I Total	%C - %I Efficiency Score	IQ
(DSF) - WISC-R Digit Span Forward Subtest	16	.52*	.41	.55*	.16	.31
(DSB) - WISC-R Digit Span Backward Subtest	16	.22	-.12	.10	.11	-.13
Stanford-Binet Intelligence Scale, Memory for Sentences (Total of Parts II and III)	16	.05	.22	.14	-.22	.44
Stanford-Binet Intelligence Scale, Memory for Sentences (Pt. II)	16	.12	.38	.25	-.21	.42
Stanford-Binet Intelligence Scale, Memory for Sentences (Pt. III)	16	-.04	0.08	-.07	-.14	.33

$^{*}p < .05$

The results did not show many high correlations, particularly for instruments supposed to be measuring the same construct. Correlations with student IQ scores were included for comparison, particularly since all these subtests were from intelligence tests. It was very interesting

that the WISC-R Digit Span Forward subtest had higher correlations with the central, incidental, and combined score than with student IQ. It was noteworthy that only the incidental score correlated in the same direction as IQ with Digit Span Backwards. This suggested the incidental task was like an unusual memory task, negatively influenced by general awareness (IQ) and extraneous stimuli (IQ). It was also interesting that Memory for Sentences Part II had the highest correlations on the other three measures and that Memory for Sentences Part III had slightly negative correlations.

Hypothesis 9 Relation to Meta-Attention

Hypothesis 9 stated that Hagen's Central Incidental Attention Task scores will correlate significantly with meta-attention scores. Meta-attention, the student's awareness of his attending, was another construct that was expected to be related to performance on Hagen's Central Incidental Attention Task. The task developed by Loper, Hallahan, and Ianna (1982) was used with the same 16 learning disabled students. The results are presented in Tables 25, 26, 27, and 28.

Table 25

Relation of Meta-Attention Scores to Selective Attention Scores

Meta-Attention Task Scores	Central Score	Incidental Score	C + I Total	%C - %I Efficiency Score
Interest	.26	.18	.26	.09
Reward	-.08	.02	-.05	-.21
Noise Distraction	-.06	-.11	-.09	.13

These correlations were not significant. Also, the Meta-Attention Task scores did not correlate significantly with any of the other selective attention measures used by Argulewicz (1982). The results suggested that students who felt interest level was the most important incentive to attention tended to perform well on the selective attention task. Those students who considered noise distraction more important tended to do slightly more poorly on the selective attention task, particularly the incidental measure.

Table 26

Correlations of Meta-Attention Test Scores

Meta-Attention	Interest	Reward	Noise Distraction
Interest	1.00	.03	-.54*
Reward		1.00	-.86*
Noise Distraction			1.00

*$p < .05$

Table 27

Correlation of Meta-Attention with Chronological Age

Interest	.08
Reward	.60*
Quiet (Noise Distraction)	-.55*

*$p < .05$

These results suggested that the pattern of performance of the LD students was from seeing noise distraction as most important for attention, then interest as an important incentive, to finally seeing reward as the critical incentive for attention.

Table 28

Correlation of Meta-Attention with PIAT Reading Scores

	Pretest Reading Recog.	Posttest Reading Recog.	Pretest Reading Comp.	Posttest Reading Comp.
Interest	-.01	.06	.22	.09
Reward	.49	.45	.47	.34
Quiet (Noise Distraction)	-.40	-.41	-.51*	-.33

*$p < .05$

These achievement results presented essentially the same pattern as chronological age. Moving from noise distraction concerns to reward concerns was an effective strategy for these LD students.

Hypothesis 10 Practice Effects Test-Retest Model

In Hagen's Central Incidental Attention Task (Hagen & Kail, 1975; Mercer, 1975) the central measure was distinguished from the incidental measure by directions to the subject identifying only the central pictures as the memory task. Consequently, once the subject had been tested on the incidental pictures, the pictures became an additional central task for attention. Thus use of the instrument in a test-retest model should have produced a lower

reliability estimate and an increased estimate of random measurement error because the task would change. However, such a model would have been expected to yield information about the nature of the process. There should have been a general improvement in both scores from the practice effect, with a greater improvement in the former incidental, now central task. A minimal increase in the former central task would have suggested that the incidental task decreased central performance. A one year interval between test and retest should have decreased the practice effect while the incidental task would still have been redefined. Table 29 presents internal correlations from the 1981 administration as a basis for comparison.

Table 29

Internal Correlations of Hagen's
Central Incidental Attention Task - 1981

Attention Scores	Central C	Incidental I	Combined C + I	Efficiency %C - %I
Central	1.00	.33	.85	.43
Incidental		1.00	.77	-.65

Hypothesis 10 stated that a test-retest model will produce an improvement in incidental task scores at the expense of central task scores on Hagen's Central Incidental Attention Task. The results are shown in Tables 30 and 31.

Table 30

Pearson Correlations for Hagen's Central Incidental Attention Task: Test-Retest Model (N = 16 LD)

March-April 1982	March - April 1981 Central	Incidental	C + I Combined	%C - %I Efficiency
Central	.79**	.45	.76**	.38
Incidental	.35	.77**	.60**	-.22
C + I Combined	.74**	.62**	.80**	.22
%C - %I Efficiency	.30	-.29	.09	.46

**p < .01

Table 31

Means and Standard Deviations for Hagen's Central Incidental Attention Task: Test-Retest Model

	March-April 1981 Mean	SD	March-April 1982 Mean	SD
Central	6.87	2.5	6.00	3.22
Incidental	2.78	1.99	1.69	1.45
C + I	9.65	3.69	7.69	4.13
%C - %I	14.48	37.22	27.50	30.40

The test-retest model developed high correlations over a one year period, but there was not the performance improvement that was expected. Five students scored lower on both central and incidental tasks. Hypothesis 10 was not supported.

Hypothesis 11 Relation to Classroom Attending Behavior

In addition to comparing Hagen's Central Incidental Attention Task scores to other selective attention measures, a meta-attention task, and itself over a one year interval, a comparison was made to teacher ratings of students' attentional behavior in the classroom. The rating scale (see Appendix C) was administered during final year testing in 1981 and again in 1982. Item number 3 on "directions" from the 1981 administration was broken down into item 3A, "oral directions," and item 3B, "written directions" for the 1982 ratings. It was given to both learning disabled students and non-learning disabled students referred for testing among the Brevard County student sample.

Hypothesis 11 stated that teacher ratings of classroom attending behavior will correlate significantly with LD student performance on Hagen's Central Incidental Attention Task. Table 32 presents the results of Spearman rank-order correlations of the 1981 administration and the correlations between the 1981 and 1982 ratings for the LD students. Table 33 shows the Spearman rank-order correlations between the 1981 and 1982 items and selective attention variables in the LD students.

Table 32

Correlation Matrix for LD Student Attending Behavior Ratings (N = 16)[1]

		1981						1982							1981
Items		1	2	3	4	5	6	1	2	3A	3B	4	5	6	Total
1981	1	1.00	.91	.70	.74	.74	.40	.61	.60	.50	.60	.61	.39	.80	.88
	2		1.00	.54	.66	.66	.33	.72	.61	.53	.64	.62	.41	.89	.81
	3			1.00	.70	.70	.38	.59	.38	.64	.67	.59	.60	.48	.79
	4				1.00		.52	.62	.32	.42	.40	.65	.21	.71	.94
	5					1.00	.52	.62	.32	.42	.40	.65	.21	.70	.94
	6						1.00	.63	.60	.58	.44	.42	.40	.57	.71
1982	1							1.00	.72	.71	.63	.49	.47	.67	.77
	2								1.00	.75	.73	.21	.40	.63	.59
	3A									1.00	.93	.38	.66	.56	.60
	3B										1.00	.36	.76	.55	.61
	4											1.00	.13	.63	.71
	5												1.00	.22	.46
	6													1.00	.83
1982 Total Score		.73	.77	.63	.60	.60	.76	.89	.84	.88	.87	.75	.71	.84	.80

[1] Correlations at or above .50 are significant at the .05 level.

Table 33

Correlations for LD Student Attending Behavior Ratings with Selective Attention (N = 16)

		C	I	SA Total C + I	SA Eff. % %C - %I	SA Group Membership	Gain Scores
1981	1	.26	.03	.18	.20	.34	.45*
Items	2	.34	.16	.31	.13	.38	.35
	3	.31	-.13	.11	.34	.38	.52**
	4	.19	-.10	.08	.22	.32	.28
	5	.19	-.10	.08	.22	.32	.28
	6	.28	-.03	.08	.09	.37	.14
1982	1	.45	.33	.42	.10	.39	.32
	2	.38	.32	.33	.04	.26	.34
	3A	.60**	.29	.47	.20	.49*	.31
	3B	.44	.12	.28	.25	.43	.31
	4	.45	.27	.47	.26	.51*	-.02
	5	.09	-.14	-.05	.04	.17	.27
	6	.42	.24	.38	.19	.56*	.08

*$p < .05$
**$p < .01$

NOTE: PIAT Reading Recognition Posttest and PIAT Reading Comprehension Posttest were also examined with correlations between -.22 and .33, none significant.

For comparison, Table 34 indicates the pattern of the correlation matrix of the Spearman rank-order correlations for the non-learning disabled group (N = 11) between items on the 1981 administration. Table 35 presents the Spearman rank-order correlations for the non-LD group (N = 11) between the items on the 1981 ratings with selective attention measures and gain scores. Because of size (N = 6), the 1982 responses were not analyzed.

Table 34

Correlation Matrix for Non-LD Student Attending Behavior Ratings (N = 11)[1]

		1	2	3	4	5	6
	1	1.00	.89	.80	.56	.56	.54
	2		1.00	.73	.64	.64	.36
1981	3			1.00	.18	.18	.31
Items	4				1.00	1.00	.38
	5					1.00	.38
	6						1.00

[1] Correlations greater than .56 are significant at the .05 level

Table 35

Correlations of Non-LD Student Attending Behavior Ratings with Selective Attention (N = 11)

		C	I	SA Total C + I	SA Eff. % %C - %I	SA Group Membership**	Gain Scores
	1	-.24	-.27	-.33	.09	—	-.19
	2	-.35	-.40	-.50	.10	—	-.39
1981	3	-.22	-.21	-.38	.03	—	.02
Items	4	.09	-.29	-.03	.45	—	-.42
	5	.09	-.29	-.03	.45	—	-.42
	6	0.00	.41	.22	-.17	—	-.39

*$p < .05$
** Because of the small sample, all but one subject was in the second group.

Table 32 illustrates that the items were relating to a general behavioral area since most of them were significantly related to each other. Items one and two covered telling and teaching directly, intended as central attention. Item three covered directions directly given to the class, thus including little incidental attending. Item four covered very incidental learning. Items five and six covered attention to task (see Appendix C).

Examination of Tables 33 and 35 shows the relationship of the items to selective attention. Of the 1981 responses for both groups, the only significant correlations were between gain scores and items one and three for the LD students. These items both referred to "direct" explanations, yet the same idea with the verb "teach" was in item two.

Item four was meant to reflect incidental learning, i.e., "things in the class that are not taught," while item two, "teach...directly," was intended to be a more central learning approach. Item four showed a negative correlation to incidental learning in both groups in 1981, with a slightly positive correlation to central score. Item four also correlated perfectly to five (+1.0). But the 1982 results contradicted this pattern. Generally patterns were not consistent.

Thus for 1982 the classwide oral directions item (item 3A) had a high correlation to central score (C), total selective attention score (C + I), and attention level. Understanding of "things...not taught," i.e., incidental learning, item four, was also correlated highly to central score (C), total score (C + I), and group membership. Item six, "how long can the student work on a high interest task" was also significantly correlated with attention level. Thus item 3A, class directions item four, incidental information, and item six, interesting task attention, all significantly correlated with attention level. Attention level was defined as either level one, central score over six and efficiency index greater than eight, or level two for any lower scores. Yet the questionnaires were not able to adequately detect behaviors specific to incidental attention.

Summary

A summary of the analysis of the data gathered concerning the hypotheses is presented in Table 36. It also corresponds to Table 1 in Chapter III.

Table 36

Summary Table for Chapter IV

Hypothesis No.	Table Report Data	Subjects No.	Group	Variables: Independent	Variables: Dependent	Significance of Results
1.	5	19 20 11/6	SIMS VAKT	Selective Attention (SA) Groups (2) Reading Program	PIAT a. Reading Recog. b. Reading Comp.	All non-significant
	6	same		SA Groups (2) Reading Program (2)	same	All non-significant
2.	7,8	19 20	SIMS VAKT	Selective Attention (C + I) Reading Program	same	*signif. - SA, Rdg.: main effect and interaction Rdg. Comp. - Non-signif. %SA: All non-signif.
3.	12	67	SIMS	Selective Attention Groups (3) Age Group	WRAT Reading Recog.	*signif. - Age others - non-signif.
4.	13,14 15	67	SIMS	Selective Attention (C + I) or (%C - %I)	WRAT Reading Achiev.	All non-significant

Table 36 - Continued

Hypothesis No.	Table Report Data	Subjects No.	Group	Variables Independent	Variables Dependent	Results
5.	16,17 18	67	SIMS	Selective Attention (C + I), (%C - %I), and Group Modality Preference Group (3)	WRAT Reading Achiev.	*signif. - modality other - non-signif.
6.	19,20 21	67	SIMS	Modality Preference Group (3) Intelligence Score	Selective Attention a. C + I b. %C - %I	All non-signif.
7.	22,23	67	SIMS	Selective Attention (C + I), Group LD Teacher	WRAT Reading Achiev.	All non-significant
8.	24	16	VAKT	Digit Span F Digit Span B SB-Memory II & III) SB-Memory Sent. II SB-Memory Setn. III	Selective Attention (C, I, C + I, %C - %I)	Pearson P-M Correlations Most non-significant
9.	25.26 27,28	16	VAKT	Meta-Attention Task	Selective Attention	Pearson P-M Correlations: Most non-significant
10.	29,30 31	16	VAKT	Selective Attention	Selective Attention	Pearson P-M Correlations: Most-signif.
11.	32.33 34.35	16 11	VAKT Non-LD	Attending Behavior Ratings	Selective Attention	Spearman Rank-order Correlations: Most non-significant

* significant at the .05 level

CHAPTER V

DISCUSSION, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Discussion

The purpose of this study was to investigate the importance of visual selective attention in learning disabled (LD) students' reading performance. A review of the literature indicated a great deal of research interest in selective attention deficiencies as a characteristic of LD students and in precision teaching as a successful teaching program for LD students. There was, however, a lack of information about the relationship between selective attention and reading performance resulting from precision teaching. Furthermore, the research on selective attention did not clearly present its relationship to LD students' reading performance. This study investigated 11 hypotheses about selective attention in three sections.

Section One

This first section was intended to compare groups of students in different reading programs in relation to selective attention. The reading programs were the Systematic Instructional Management Strategies (SIMS) program, the Visual-Auditory-Kinesthetic-Tactile (VAKT) program, or the regular classroom's basal reading program.

Hypothesis 1

Hypothesis 1 predicted that the SIMS program would alleviate the effects of poor selective attention so that selective attention would thus interact with reading group membership and also significantly

influence reading performance in all groups. The lack of significance in the statistical tests for this hypothesis indicated that these relationships are not important to reading performance in this sample. However, the small sample size and skewed SIMS group pretest scores may also have obscured any effect.

<u>Hypothesis 2</u>

Hypothesis 2 examined how different definitions of selective attention would relate to reading performance. Some of the comparisons using the non-LD basal reading program students had only six subjects and, although interesting, were not included later. Also, the students in the VAKT program performed much higher than the SIMS program subjects on both the pretest and posttest, though their scores were lower than the non-LD subjects. This could be due to the program differences, but could also be explained by IQ differences, teacher differences, or to socio-economic/geographic differences between the two groups. These differences between the groups existed prior to this study.

The results showed several significant relationships. The relationship between selective attention as total capacity (C + I) and the dependent variable, PIAT reading recognition, was significant ($p < .05$). There was also a significant relationship between the reading group and reading recognition ($p < .05$). Finally, the interaction of selective attention as total capacity (C + I) and the two reading programs with the dependent variable, PIAT reading recognition, was also significant ($p < .05$). The difference in selective attention means for the two groups, 8.74 (SIMS) to 9.40 (VAKT), was only .66.

The scatter plot indicated that the SIMS group's points on C + I were more dense, though both groups showed an increase in reading with the C + I increase. The major observation was the considerable difference between the samples, in reading levels and in density, and this encourages skepticism. The differences seemed to be primarily due to the differences in the two subject samples. Because of the problems with the subject samples, it was important that this finding occur again with the larger sample in hypothesis four to clarify the source of these differences. Finally, the hypothesis that the combined measure, C + I, was more descriptive of the selective attention process than the efficiency measure (%C - %I) was not rejected.

Section Two

The larger sample (N = 67) of LD students in the SIMS program showed a normal distribution for IQ scores and age. The groups formed by selective attention level had 26 (1), 25 (2), and 17 (3) subjects.

Hypothesis 3

This investigation predicted that reading performance would be significantly different for a group of subjects with good selective attention and two other groups with poor selective attention, one having adequate overall performance and the other poor overall performance. The means of the reading scores supported ths hierarchy. However, the main effect of selective attention group level was not significant, though age differences, as expected, did relate significantly to achievement.

Hypothesis 4

This investigation was the same as for Hypothesis 2, except that it uses the subjects of Section Two. In Hypothesis 2 significant relationships were found using the selective attention combined measure (C + I), but here no significant relationships between selective attention and reading were found, using either the combined measure (C + I) or the efficiency index (%C - %I). This makes the results of hypothesis 2 more suspect since it had a smaller sample size and because of the initial differences between the groups being compared.

Hypothesis 5

In discussing these results it was important to remember, as explained in Chapter III, that modality preference was just the assignment of one of three values. When selective attention was defined by group membership, modality preference had a significant relationship to reading performance ($p < .05$). When the other definitions were used, i.e., combined (C + I), or, the efficiency index (%C - %I), the results of this analysis showed that modality preference did not significantly explain reading achievement.

Hypothesis 6

This hypothesis went one step further and used each of the two continuous definitions of selective attention as the dependent variable. This did not show a significant relationship between modality preference and selective attention, defined either as the combined measure (C + I) or the efficiency index (%C - %I). Intelligence score (IQ) was not significant either uniquely or when entered after modality preference. However, the sizes of the modality groups were very unbalanced.

The plot of this interaction of modality preference with selective attention and intelligence was discussed at length in Chapter IV and was shown in Figure 1. Though not statistically significant, it provided interesting information about Hypothesis 6 and the nature of the underlying relationship between these three indices of performance. Its consistency was surprising. The plot showed a disordinal type of relationship, revealing how visual modality performance and visual selective attention might be related, relative to general intelligence. Thus students with adequate visual modality scores increased their selective attention scores as their intelligence increased. Surprisingly, students with low performance in the visual modality subtests decreased their selective attention performance with increasing ability. Thus an underlying processing preference was tapped by both visual selective attention and modality preference group. This preference also could work in opposition to the general, native or innate ability (IQ).

Hypothesis 7

This test was intended to insure that any results were not primarily due to teacher or classroom differences. The results showed that any effects that could be attributed to the teacher were not significant.

Section Three

This section was devoted to examining the experimental measure of selective attention used, Hagen's Central Incidental Attention Task. This was intended to both clarify the construct and define the limitations of the measure.

Hypothesis 8

This hypothesis was intended to see how the instrument, Hagen's Central Incidental Attention Task, related to the measures of selective attention used by Argulewicz (1982). The results showed surprisingly low correlations. Furthermore, the incidental measure, which was the most distinctive measure in determining selective attention, followed the magnitude and direction of the general pattern of correlations shown by the intelligence score (IQ). It followed this pattern closer than the central score, though the opposite was expected.

The results showed that, of Argulewicz's measures, only the Digit Span Forward Subtest of the WISC-R correlated significantly with any of the selective attention measures, the combined score (C + I). Thus Argulewicz's battery seemed to be measuring constructs different from Hagen's selective attention instrument.

Furthermore, in analyzing Hagen's instrument, the results suggested that the central score measured a relatively pure, sequential, rote memory ability like the Digit Span Forward Subtest. The incidental score did not. It corresponded more closely to overall intellectual factors. Therefore it was more like verbal ability and related general abilities such as abstract and symbolic abilities.

Hypothesis 9

This hypothesis tested the relationship between performance on Hagen's Central Incidental Attention Task and scores on the Meta-Attention Task developed by Loper, Hallahan and Ianna (1982)

in Appendix D. The results showed that the three meta-attention preferences do not correlate significantly with Hagen's Central Incidental Attention Task or any of the other selective attention measures studied in hypothesis eight. The general trend, though not significant, was for students with higher scores on the interest variable to show positive correlations with the selective attention task. Students considering noise distraction and rewards more important tended to show negative or very low correlations. Thus increasing the interest ratings corresponded to increasing selective attention (C + I). This agreed partially with Loper, Hallahan, and Ianna's (1982) finding that "interest" represents a higher developmental level.

The results showed significant correlations between chronological age and the reward (positive correlation) and quiet (negative correlation) preferences. Only one correlation with achievement testing was significant. However, the same pattern occurred in all cases, and this is important. The "reward" category had a large positive correlation to age (significant), reading recognition pretest and posttest, and reading comprehension pretest and posttest. The interest category had the weakest correlations in each case. The "quiet" category had large negative correlations in each case.

The results suggested that as the LD students age, the quiet rating becomes less important and the reward rating becomes more important. Increasing academic performance corresponded to changing ratings from the quiet condition to the reward condition.

These results differed from the findings of Loper, Hallahan, and Ianna (1982). They found that as age increased, students received higher scores on the interest variable and lower scores on the reward variable. In the normal and successfully treated LD student, this relationship also occurred with achievement. This study, with a smaller sample, did not find a strong correlation between age or achievement and rating "interest" as important.

Hypothesis 10

This hypothesis attempted to measure the instrument's reliability and, more importantly, to provide insight into the changes and relationships between the scores over one year. The results were surprising. Performance on the incidental task did not dramatically improve. Thus the relationship between the scores remained essentially the same.

The central, incidental, and combined (C + I) scores all correlated significantly, and showed a surprisingly high reliability. The efficiency index (%C - %I) showed only a .46 correlation. It showed an increase in its mean value over the year interval while the other measures showed a decrease. The results did not provide information on how an incidental score increase would affect the central score or similar questions raised by Douglas and Peters (1979).

Hypothesis 11

This hypothesis investigated the relation of Hagen's Central Incidental Attention Task to ratings of actual attending behavior (Appendix C). Hallahan (1975) was unable to find a relationship between the attention task and behavioral observation measures of

attention and hyperactivity in institutionalized LD children. Consequently, information about how they relate in this dissertation sample would help guide generalizations about this study.

As explained in Chapter IV, the overall patterns were not completely consistent. Item four, designed to show selective attention with incidental information, correlated significantly in identifying student's selective attention performance level, but showed negative correlations in 1981 with the incidental score. Obviously, incidental attending was too subtle a behavior to be detected by such global questions. The significant correlations between items three, four, and six showed that the classification of students into two levels by Hagen's task relates significantly to attention/memory behaviors in the classroom.

Conclusions

Selective Attention and Reading

There was no evidence supporting the idea of differentiation of reading performance due to favorable interaction of precision teaching and selective attention compared to other reading programs. Furthermore, the only evidence showing that selective attention performance is related to reading achievement appears to be a product of group differences. The characterization of selective attention provided by the combined measure, total processing capacity under distraction (C + I), did correspond more closely to academic performance than the selective attention efficiency index (%C - %I).

Chapter II showed that these results differed from the series of studies by Hallahan and researchers at the University of Virginia (Hallahan, 1975; Hallahan, Kauffman, & Ball, 1973). However, Mercer (1975) did not obtain a relationship to underachievement, though presumably it was due to sample size (N = 15). Swanson (1979) also could not differentiate LD and normal students on Hagen's task when using a small sample (N = 15).

Finally there were several different techniques available for measurement of selective attention that aren't necessarily measuring exactly the same construct (Argulewicz, 1982; Santostefano, 1964; Schworm, 1982). This study showed that Hagen's Central Incidental Attention Task did not correspond closely to the measures used by Argulewicz (1982). Furthermore, Hagen's Central Incidental Attention Task still included theoretical relationships between central and incidental measures that remain untested. Though the lack of reliability and validity data limited the effective use of Hagen's task, this study provided new suggestions for both.

Some of the limitations influencing research in this area involved the definitions of both selective attention and learning disabilities. There were many different definitions of selective attention confusing the literature and the distinctions between these and memory, field independence, cognitive tempo, field articulation, impulsivity, distractibility, are difficult to define. Likewise, different counties, states, etc. and research groups used different criteria for identification and diagnosis of learning disabilities. The use of learning disabled

students also limited generalizability because extreme differences may exist between different LD students.

Selective Attention and Modality Preference

Modality preference did not assist selective attention in explaining reading achievement, though in one case it showed a relationship to reading when selective attention was defined by group membership. It did show a complicated relationship to selective attention and intelligence, suggesting an underlying learned preference. These results suggested that modality preference was the result of the learning contingencies, but not necessarily the cause.

The disordinal pattern showed students with low visual modality performance decreasing their selective attention performance with increasing ability. This argued that the underlying processing preference, tapped by both visual selective attention and modality preference group, was learned. This was consistent with the research of Koorland and Wolking (1982) suggesting preferred modality as an adaptation to reinforcement variables. Higher intelligence increased responsiveness to the contingencies of reinforcement. This explains the paradox that an increase in telligence would decrease performance on a visual task involving memory. The intelligent LD student responded to contingencies surrounding poor visual performance and good auditory performance. The student learned to repress visual information. The degree of repression shown in Figure 1 thus corresponds to adaptive ability (IQ), and therefore learning ability, too perfectly to support any explanation as an independent facility.

The major limitations of this part of the dissertation were the unbalanced sample sizes of the modality groups, and the limitations of the instruments. The measurement and determination of the modality processes relied on relationships that are untested or unproven. The Detroit Test of Learning Aptitude (DTLA) also lacked appropriate norms for comparison.

Selective Attention Measurement

Hagen's Central Incidental Attention Task was not measuring the selective attention construct that Argulewicz (1982) measured. The results showed that part of the task's scores, the central score and the combined score (C + I), only correlated significantly with the Digit Span Forward subtest of the Wechsler Intelligence Scale for Children--Revised (WISC-R). This directly contradicted Argulewicz's results (1982) where training in attending influenced the other two measures but not the Digit Span Forward subtest score.

Hagen's Central Incidental Attention Task did not correlate significantly with meta-attention. However, the results did partially agree with the finding by Loper, Hallahan, and Ianna (1982) that high interest ratings represent an upper developmental level. Interest scores had a positive correlation with central score (C) and combined selective attention score (C + I).

The pattern for increasing age or academic achievement did not find the developmental trend reported by Loper, Hallahan, and Ianna (1982), from reward orientation to interest orientation. Instead reward orientation showed strong positive correlations to age and to achievement while interest showed weak correlations.

Hagen's Central Incidental Attention Task did not show an increase in incidental scores in a test-retest administration over one year. Thus the incidental task was not redefined into being a central task after the first administration. Thus, over a long enough interval, the instrument showed a fairly high reliability, using central (C), incidental (I) or combined scores (C + I). However the general decrease in performance observed complicates these results since they may be due to unusual circumstances. Patterns of changes in the incidental scores were not obtainable.

The results of Hagen's Central Incidental Attention Task correlated significantly with some general attending behaviors in LD students. From the 1982 administration, high selective attention performance level was related successfully to oral directions given to a whole class. It also related to understanding the things in class that are not specifically taught. Finally it related to time spent in a high interest task.

Theoretical Implications

In his theory about selective attention summarized earlier, Ross (1976) suggested that modality and attention interact. He also suggested that a student's modality preference may be a consequence rather than an on-going cause of the student's processing. This model of selective attention stages has implications for modality preference.

His first stage, overselection, was expected to make the child process in one modality, perhaps as a consequence of more ability or

of arbitrarily having more reinforcers, as suggested by Koorland and Wolking's (1982) research. Due to a developmental delay, this student continued with the overselective emphasis on one modality. This complicated the task of matching graphemes (visual) to phonemes (auditory), producing a delay in learning reading.

Pelham (1981) criticized the idea of an attention deficit in LD children because they perform well on a lot of everyday tasks that would also require selective attention. He suggested that an LD cognitive deficit is less pervasive than attention dysfunction. He suggested it is specific to the academic tasks on which LD children have difficulty. This is compatible with the general idea that both selective attention and modality preference were not inherent abilities in the learner. Yet when the two interact, they reinforced the student's problems in mastering reading as a complex multifaceted task. And as they improved with maturity, specific academic deficits persisted.

Upon reaching the next, overinclusive stage (underselective), the student was finally behind enough to be labeled learning disabled. He had a strong modality bias for whichever modality has been the most stable for him. The major impetus for the bias disappeared, i.e., underselective attention, through maturation. However, the bias, as suggested by disordinal reaction in Figure 1, remained as a strongly reinforced, learned behavior which continues after the student developed selective attention. The academic deficit would be continued by the passive stance the learner takes, the history of negative experiences with the task, being behind in the curriculum, or the use of the inappropriate or less effective learned modality preference.

Recommendations for Further Research

Further research might pursue the clarification of the concept, selective attention, by examining the interaction of incidental with central elements in many tasks. The instrument, Hagen's Central Incidental Attention Task, should be further examined for reliability, validity, and changing patterns between the incidental and central measures at different ages and attentional capacity demands. The result suggesting that Hagen's task's reliability may be testable could be used to improve the knowledge of its characteristics as well as the modified versions of the task developed at the University of Virginia Learning Disabilities Institute.

The relationship found between selective attention, as total capacity (C + I), and intelligence and modality preference needs to be explored further. Developmental trends in selective attention and in modality processes need to be clarified, primarily in the case of learning disabled students. Single subject designs with LD students at certain selective attention stages could be used effectively for studying these patterns of modality processing and particular characteristics of hierarchical reading tasks. The result could be a more thorough understanding of the complicated interactions that lead to the academic deficits of learning disabled students.

APPENDIX A

SPECIFIC LEARNING DISABILITIES GUIDELINES FOR MARION COUNTY

I. Referral Process

A. A pre-referral form must be secured from your guidance counselor or SLD teacher. The following information must be included:

1. Documented and dated evidence of conferences held concerning the student's specific problem. These conferences shall include, but not be limited to - the parents or guardians, administrative personnel and teaching personnel.

2. Written behavioral observations in the classroom which indicate the student's learning problem.

3. Documented evidence of two (2) educational alternatives attempted within the school.

4. Evidence of the student's sensory functioning (hearing and vision; language screenings).

5. Any social, psychological or medical data included in the student's cumulative folder.

6. Student attendance record if excessive absences are noted and reasons for the excessive absenteeism.

B. Psychological Referral

For students with IQ 85 and above, the pre-referral form will serve as formal referral when sent to the SLD teacher.

Fill out standard psychological referral (see page 17) if SIT IQ is below 84, and include the following:

1. All pre-referral information.
2. All available test scores including a counselor administered Slosson Intelligence Test.
3. Written permission for evaluation.

IF THE SLOSSON IS IQ 85 OR ABOVE, THE COMPLETE REFERRAL SHOULD BE SENT DIRECTLY TO THE SLD INSTRUCTOR IN YOUR SCHOOL.

<u>IF THE SLOSSON IS IQ 84 OR BELOW, THE COMPLETE REFERRAL SHOULD BE SENT DIRECTLY TO PSYCHOLOGICAL SERVICES.</u>

II. Criteria for Eligibility

The specific learning disability definition (6A-6.3018) is as follows:

"...one who exhibits a disorder in one (1) or more of the basic psychological processes involved in understanding or in using spoken and written language. These may be manifested in disorders of listening, thinking, reading, talking, writing, spelling, or arithmetic. They do not include learning problems which are due primarily to visual, hearing or motor handicaps, to mental retardation, to emotional disturbance, or to an environmental deprivation."

The process, academic and exclusion factors of the aforementioned definition, which exists in the State Board of Education Regulations has been operationalized according to the following criteria:

A student is eligible if: (6A-6.3018)

1. enrolled in the public schools.

2. evidence supports that learning problems are not due primarily to other handicapping conditions.

   a. A score of not less than two (2) standard deviations below the mean on an individual test of intellectual functioning or evidence that a score below two (2) standard deviations below the mean is not a reliable indicator of the student's intellectual potential.

   b. For students with visual processing deficits, visual acuity of at least 20/70 in the better eye with best possible correction or evidence that the student's inability to perform adequately on tasks which require visual processing is not due to poor visual acuity.

   c. For students with auditory processing or language deficits, auditory acuity of not more than a 30 decibel loss in the better ear unaided or evidence that the student's inability to perform adequately on tasks which require auditory processing of language is not due to poor auditory acuity.

d. For students with a motor handicap, evidence that their inability to perform adequately on tasks which assess the basic psychological processes is not due to the motor handicap.

e. No evidence of a primary emotional disturbance as based on test data or on the clinical judgment of a qualified psychologist. For students who exhibit persistent and consistent severe emotional disorders, evidence must be presented to establish that the inability to perform adequately on tasks which assess the basic psychological processes is not primarily due to the emotional disorder.

3. Documented evidence indicates that viable general education alternatives have been attempted and found to be ineffective in meeting the student's educatoinal needs.

4. Evidence of ACADEMIC deficits:

a. Based upon the student's expected level of functioning, a score of: 85% expectancy age or below for 3-6 years of school attendance; 75% expectancy age or below for 7-9 years of school attendance; or 65% expectancy age or below for 10 or more years of school attendance is required in one (1) or more of the following academic areas: reading, writing, arithmetic, or spelling. For students in grades K-2, evidence must be presented that achievement is below the student's expected level on pre-academic tasks which require listening, thinking, or speaking skills.

b. Evidence of a disorder in one (1) or more of the basic psychological processes:

Based on a student's expected level of functioning a score of less than two (2) standard deviations below the mean in one (1) or more process areas or a score of less than one and one-half (1½) standard deviations below the mean in three (3) or more process areas. Process areas are defined as: visual channel processes, auditory channel processes, haptic channel processes, language processes, and sensory integrated processes. In cases where 70% of the student's expectancy age is in one (1) process area or less than 80% in three (3) or more process areas may be used.

III. Steps for Reevaluation

Reevaluation is conducted annually by the SLD instructor. Recommended program changes will be discussed by the staffing committee.

IV. Dismissal

Students are dismissed from the program when they have achieved the perceptual skills and/or academic skills required to learn in the classroom according to his/her expectancy age. Testing instruments used in initial placement will be used in re-evaluation for dismissal.

Re-assignment

A student will be considered for re-assignment when he/she demonstrates a lack of progress which might indicate a need for another type of service within the school system.

V. Contact Person

A. SLD teacher serving your school center
B. Program chairperson
C. Psychologist
D. Supervisor, Exceptional Student Education

Adapted from: Student services handbook 1979-80. Ocala, Fla.: Marion County Public Schools, 1980.

APPENDIX B

HAGEN'S CENTRAL-INCIDENTAL ATTENTION TASK

DIRECTIONS: Hagen Central-Incidental Attention Task

Oral Directions to the student: I will be showing you some cards. Pay attention to the animal. I will ask you to point to the correct animal after I show you several cards.

PROCEDURE: Central Task: Present each 3 x 6 stimulus card face up for two seconds, then place it face down in front of the subject in a manner which proceeds from the subject's left to right. After the last card for each trial, present the cue card identical to one of the trial cards and ask the subject to select the matching card. On the data sheet, with name or other identification at the top, indicate under Central Task, Response, whether the student was correct (+) or not (-). The number of successful trials is the Central Task Score.

Practice Trial: Before beginning trial 1 on the Central Task sheet, use the three practice cards before trial 1. Show them to the student, place them face down, then ask the student to point to the camel. Repeat this procedure but ask the student to point to the dog. Show them the correct response if they make an error. Now begin with trial 1.

PROCEDURE: Incidental Task: Hagen's incidental task immediately follows the Central Tasks, trial 12. It must only follow the Central Task. Present to the student the 22 x 6 inch piece of cardboard with the six animals. Next give the student pictures (3 x 3 inch) of the six household objects and instruct them to match the household object (incidental stimulus) with the animal picture (central stimulus). The incidental score is obtained by recording the number of correct pairings at the bottom of the data sheet. This task can only be used with the student once, then it would become a Central Task.

Name______________________ CA______________

Group______________________ MA______________

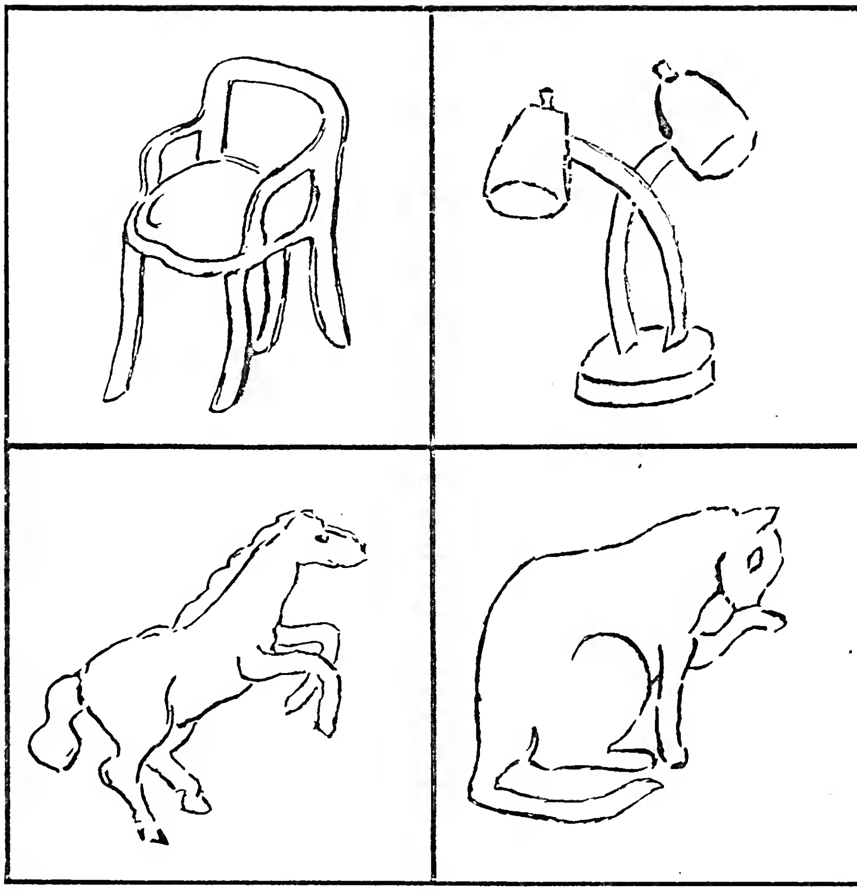
Date Tested______________________ IQ______________

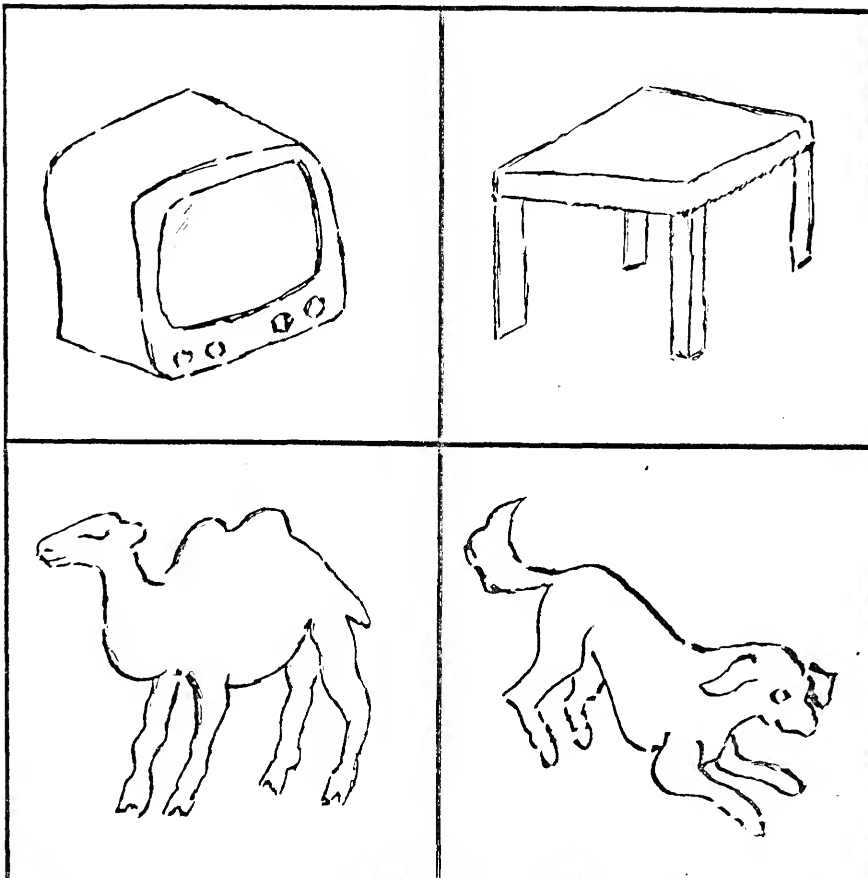
		CENTRAL TASK								
		Position								
Trial	Length	1	2	3	4	5	6	Pos.	Pict.	Resp.
1	3	Deer	Monkey	Horse				1	Deer	
2	4	Monkey	Deer	Cat	Dog			4	Dog	
3	5	Horse	Dog	Camel	Cat	Deer		3	Camel	
4	6	Deer	Monkey	Dog	Cat	Camel	Horse	2	Monkey	
5	3	Cat	Horse	Monkey				1	Cat	
6	6	Dog	Camel	Monkey	Horse	Deer	Cat	4	Horse	
7	5	Camel	Cat	Dog	Horse	Monkey		1	Camel	
8	5	Camel	Cat	Horse	Monkey	Dog		3	Horse	
9	3	Monkey	Dog	Deer				2	Dog	
10	6	Cat	Horse	Camel	Deer	Monkey	Dog	5	Monkey	
11	4	Horse	Deer	Dog	Camel			2	Deer	
12	4	Dog	Camel	Cat	Deer			3	Cat	

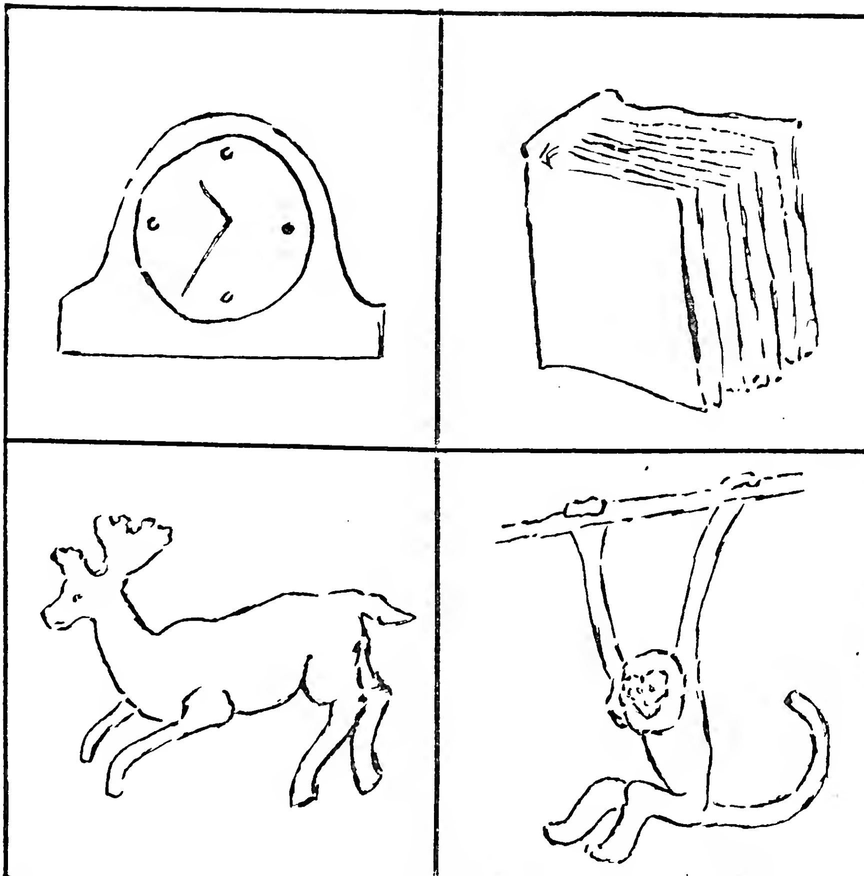
INCIDENTAL TASK

Cent.	Camel	Cat	Deer	Dog	Horse	Monkey
Incid.	T.V.	Lamp	Clock	Table	Chair	Book
Response						

Total Central________________ Total Incidental________________







APPENDIX C

TEACHER RATING OF STUDENT'S ATTENDING BEHAVIOR (1981)

Please use your best assessment of ________________ on the following questions and circle the number representing your choice.

1. When you tell this student something directly, does he process that information:

worst in the class	poorly	about average for the class	well	the best in the class
1	2	3	4	5

2. When you try to teach this student something directly, does he process that information:

worst in the class	poorly	about average for the class	well	the best in the class
1	2	3	4	5

3. When you are giving directions to the whole class, does this student process that information:

worst in the class	poorly	about average for the class	well	the best in the class
1	2	3	4	5

4. Does this student understand things in the class that are not taught, such as when the class will change activities, what day special programs will happen, etc.:

worst in the class	poorly	about average for the class	well	the best in the class
1	2	3	4	5

5. How long can this student work on classroom work tasks:

worst in the class	poorly	about average for the class	well	the best in the class
1	2	3	4	5

6. How long can this student work on high interest (for them) tasks:

worst in the class	poorly	about average for the class	well	the best in the class
1	2	3	4	5

TEACHER RATING OF STUDENT'S ATTENDING BEHAVIOR (1982)

Please use your best assessment of ________________ on the following questions and circle the number representing your choice.

1. When you tell this student something directly, does he process that information:

worst in the class	poorly	about average for the class	well	the best in the class
1	2	3	4	5

2. When you try to teach this student something directly, does he process that information:

worst in the class	poorly	about average for the class	well	the best in the class
1	2	3	4	5

3. When you are giving oral directions to the whole class, does this student process that information:

worst in the class	poorly	about average for the class	well	the best in the class
1	2	3	4	5

4. When you are giving written directions to the whole class, does this student process that information:

worst in the class	poorly	about average for the class	well	the best in the class
1	2	3	4	5

5. Does this student understand things in the class that are not taught, such as when the class will change activities, what day special programs will happen, etc.:

worst in the class	poorly	about average for the class	well	the best in the class
1	2	3	4	5

6. How long can this student work on classroom work tasks:

worst in the class	poorly	about average for the class	well	the best in the class
1	2	3	4	5

7. How long can this student work on high interest (for them) tasks:

worst in the class	poorly	about average for the class	well	the best in the class
1	2	3	4	5

APPENDIX D

META-ATTENTION TASK

A. Read the verbal description for each card to the child.

On each of 12 pairs of these items the child is asked the forced-choice question: "Which of these two children do you think will pay better attention?"

B. 1 - 3 - 5 cards: Place toward the student:

common card  different cards

1. (Cards: 1 + 3 or 1 + 5) "Here is a child who is very interested in what he is doing and gets very much m ney as a reward for what he is doing." (1 + 3)

   "Here is a child who is very interested in what he is doing and is working in a room that is not very noisy." (1 + 5)

   Which of these two children do you think will pay better attention?

2. (Cards: 3 + 1 or 3 + 5) "Here is a child who gets very much money as a reward for what he is doing and is very interested in what he is doing." (3 + 1)

   "Here is a child who gets very much money as a reward for what he is doing and is working in a room that is not very noisy." (3 + 5)

   Which of these two children do you think will pay better attention?

3. (Cards: 5 + 1 or 5 + 3) "Here is a child who is working in a room that is not very noisy and is very interested in what he is doing." (5 + 1)

   "Here is a child who is working in a room that is not very noisy and is getting very much money as a reward for what he is doing." (5 + 3)

   Which of these two children do you think will pay better attention?

C. 2 - 4 - 6 cards

4. (Cards: 2 + 4 or 2 + 6) "Here is a child who is not very interested in what he is doing and does not get much money as a reward for what he is doing." (2 + 4)

   "Here is a child who is not very interested in what he is doing and is working in a room that is very noisy." (2 + 6)

   Which of these two children do you think will pay better attention?

5. (Cards: 4 + 2 or 4 + 6) "Here is a child who does not get much money as a reward for what he is doing and who is not very interested in what he is doing." (4 + 2)

   "Here is a child who does not get much money as a reward for what he is dring and is working in a room that is very noisy." (4 + 6)

   Which of these two children do you think will pay better attention?

6. (Cards: 6 + 2 or 6 + 4) "Here is a child who is working in a room that is very noisy and is not very interested in what he is doing." (6 + 2)

   "Here is a child who is working in a room that is very noisy and does not get much money as a reward for what he is doing." (6 + 4)

   Which of these two children do you think will pay better attention?

D. All Cards

7. (Cards: 1 + 4 or 1 + 6) "Here is a child who is very interested in what he is doing and does not get much money as a reward for what he is doing." (1 + 4)

   "Here is a child who is very interested in what he is doing and is working in a room that is very noisy." (1 + 6)

   Which of these two children do you think will pay better attention?

8. (Cards: 3 + 2 or 3 + 6) "Here is a child who gets very much money as a reward for what he is doing and is not very interested in what he is doing." (3 + 2)

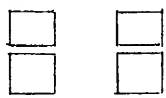
"Here is a child who gets very much money as a reward for what he is doing and is working in a room that is very noisy." (3 + 6)

Which of these two children do you think will pay better attention?

9. (Cards: 5 + 2 or 5 + 4) "Here is a child who is working in a room that is not very noisy and is not very interested in what he is doing." (5 + 2)

"Here is a child who is working in a room that is not very noisy and does not get much money as a reward for what he is doing." (5 + 4)

Which of these two children do you think will pay better attention?

E. All Cards 

10. (Cards: 1 + 6 or 2 + 5) "Here is a child who is very interested in what he is doing and is working in a room that is very noisy." (1 + 6)

"Here is a child who is not very interested in what he is doing and is working in a room that is not very noisy." (2 + 5)

Which of these two children do you think will pay better attention?

11. (Cards: 1 + 4 or 2 + 3) "Here is a child who is very interested in what he is doing and does not get much money as a reward for what he is doing." (1 + 4)

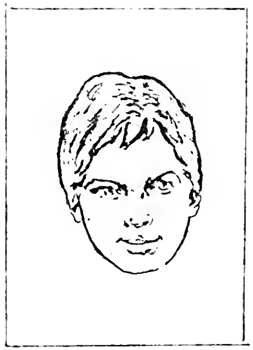
"Here is a child who is not very interested in what he is doing and gets very much money as a reward for what he is doing." (2 + 3)

Which of these two children do you think will pay better attention?

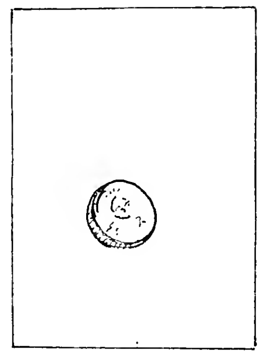
12. (Cards: 3 + 6 or 4 + 5) "Here is a child who gets very much money as a reward for what he is doing and is working in a room that is very noisy." (3 + 6)

    "Here is a child who does not get much money as a reward for what he is doing and is working in a room that is not very noisy." (4 + 5)

    Which of these two children do you think will pay better attention?



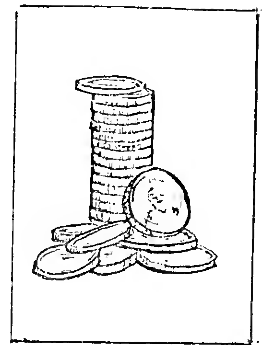
2. Imagine a child who is not very interested in what he is doing (Low-Interest Card).



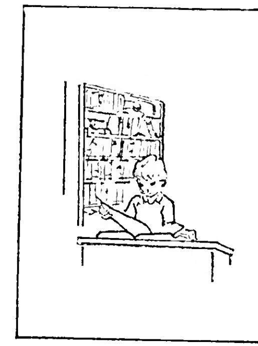
4. Imagine a child who does not get much money as a reward for what he is doing (Low-Reward Card).

6. Imagine a child who is working in a room that is very noisy (Low-Quiet Card).

1. Imagine a child who is very interested in what he is doing (High-Interest Card).



3. Imagine a child who gets very much money as a reward for what he is doing (High-Reward Card).



5. Imagine a child who is working in a room that is not very noisy (High-Quiet Card).

META-ATTENTION TASK ANSWER SHEET

Code or Name______________________________

A. _____

B. 1. _____ (3 or 5)

2. _____ (1 or 5)

3. _____ (1 or 3)

C. 4. _____ (4 or 6)

5. _____ (2 or 6)

6. _____ (2 or 4)

D. 7. _____ (4 or 6)

8. _____ (2 or 6)

9. _____ (2 or 4)

E. 10. _____ (1 - 6 or 2 - 5)

11. _____ (1 - 4 or 2 - 3)

12. _____ (3 - 6 or 4 - 5)

Adapted from: Loper, A. B., Hallahan, D. P., & Ianna, S. O. Meta-attention in learning disabled and normal students. Learning Disability Quarterly, 1982, 5 (3), 29-36.

APPENDIX E

DATA COLLECTION FORM

SLD TEACHER__________________________ SCHOOL______________________

Please supply this information for 1980-81 on your students, and if available the 1979-80 information. Items 5 or 6 mdy be the WRAT or PIAT. Item 7 is additional volunteer testing.

STUDENT NAME__________________________

1979-80 School Year

1. CA_____ DOB_____
   IQ_____ Date_____
   _____Slossen
   _____WISC/S-B

2. Diagnosis: LD_____ EH_____ Hyperactive_____

3. DTLA (Circle below 70% EA)

Auditory		Visual			
1.	_____	1.	_____	5.	_____
2.	_____	2.	_____	6.	_____
3.	_____	3.	_____	7.	_____
4.	_____	4.	_____		

4. GFW: Recog. Mem. _____
   Content _____
   Sequence _____

5.	Pre-Ach. Test _____	6.	Post-Ach. Test _____
	Pre-Rdg. Recog. _____		Post-Rdg. Recog. _____
	Date _____		Date _____
	Pre-Spell. _____		Post-Spell. _____
	Date _____		Date _____
	Pre-Rdg. Comp. _____		Post-Rdg. Comp. _____
	Date _____		Date _____
	Pre-Math _____		Post-Math _____
	Date _____		Date _____

7. Select. Atten. Test: Central _____/12 Incidental _____

8. Time in SLD Prog. _____months/1979-80;
   in SIMS _____months/same year
   Average time per week _____hrs.

1980-81 School Year

1. CA_____ DOB_____
   IQ_____ Date_____
   ___Slossen
   ___WISC/S-B

2. Diagnosis: LD___ EH___ Hyperactive___

3. DTLA (circle below 70% EA)

Auditory		Visual			
1.	_____	1.	_____	5.	_____
2.	_____	2.	_____	6.	_____
3.	_____	3.	_____	7.	_____
4.	_____	4.	_____		

4. GFW: Recog. Mem. _____
   Content _____
   Sequence _____

5.	Pre-Ach. Test	_____	6. Post-Ach. Test	_____
	Pre-Rdg. Recog.	_____	Post-Rdg. Recog.	_____
	Date	_____	Date	_____
	Pre-Spell.	_____	Post-Spell.	_____
	Date	_____	Date	_____
	Pre-Rdg. Comp.	_____	Post-Rdg. Comp.	_____
	Date	_____	Date	_____
	Pre-Math	_____	Post-Math	_____
	Date	_____	Date	_____

7. Select. Atten. Test: Central _____/12 Incidental _____

8. Time in SLD Prog. _____months/1979-80;
   in SIMS _____months/same year
   Average time per week _____hrs.

APPENDIX F

TEACHER RATING FORM FOR SIMS PROGRAM (1981)

This is a confidential questionnaire that should be returned directly to Dan Becton. It is needed to report SLD teachers' opinions.

Please mark one:

1. Do you think the SIMS program is:
   ___A. more effective than any other reading approach
   ___B. is less effective than some other reading approach
   ___C. is just like any other reading approach

2. Do you think the SIMS program:
   ___A. takes more effort to teach than most reading programs
   ___B. takes less effort to teach than most reading programs
   ___C. takes the same effort to teach as other reading programs

3. If you had to decide today:
   ___A. would you want to continue with the SIMS program
   ___B. would you want to stop using the SIMS program

4. Do you feel the information on the Detroit scores (DTLA) of your students:
   ___A. is necessary to teach them
   ___B. is interesting but not necessary to teach them
   ___C. is useless in teaching them
   ___D. is useful for diagnosis but not teaching

5. Do you feel the SIMS program offers you enough opportunity to teach the words any way you wish outside of the timings?

TEACHER RATING FORM FOR SIMS PROGRAM (1982)

This is a confidential questionnaire, like that administered in Summer 1981, that should be returned directly to Dan Becton. It is needed to report SLD teachers' opinions this year.

Please mark one:

1. Did you use the SIMS this year: Yes___ No___
   Did you use it with the same students as last year: Yes___ No___

2. Do you think the SIMS program is:
   _____A. more effective than any other reading approach
   _____B. is less effective than some other reading approach
   _____C. is just like any other reading approach

3. Do you think the SIMS program:
   _____A. takes more effort to teach than most reading programs
   _____B. takes less effort to teach than most reading programs
   _____C. takes the same effort to teach as other reading programs

4. If you had to decide today:
   _____A. would you want to continue with the SIMS program
   _____B. would you want to stop using the SIMS program

5. Do you feel the SIMS program offers you enough opportunity to teach the words any way you wish outside of the timings?
   Yes_____ No_____

I would appreciate knowing your name. However, if you wish to remain anonymous, that is okay. The results of the survey will be reported as a footnote clarifying the SIMS data showing the number of teachers choosing each answer.

Thank you.

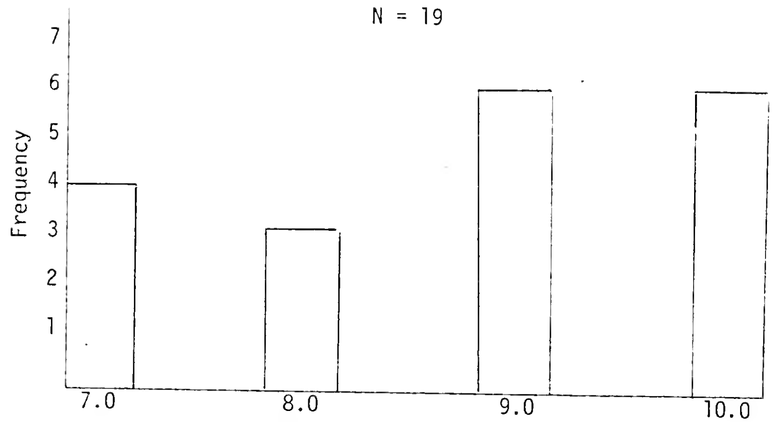
Dan Becton

Name__________________________

APPENDIX G

CHARACTERISTICS OF THE LD STUDENTS

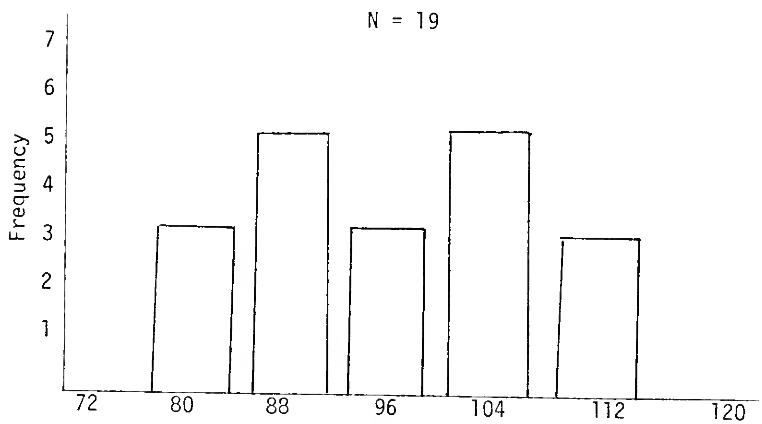
Characteristics of the LD Student in the SIMS Group



Chronological Age in Years

Figure 1

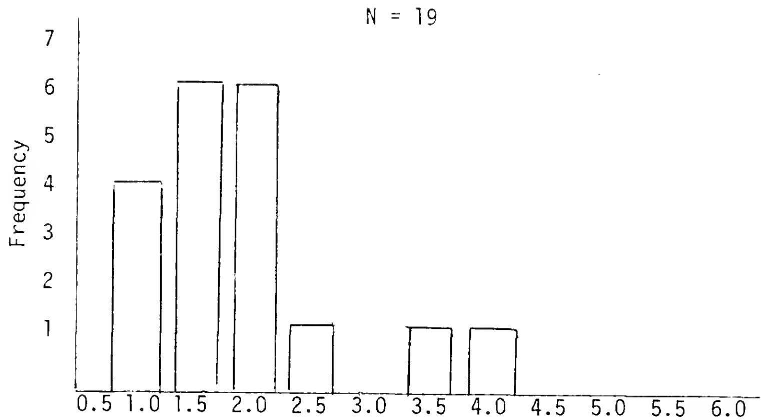
A Frequency Bar Graph of Chronological Age



IQ Scores

Figure 2

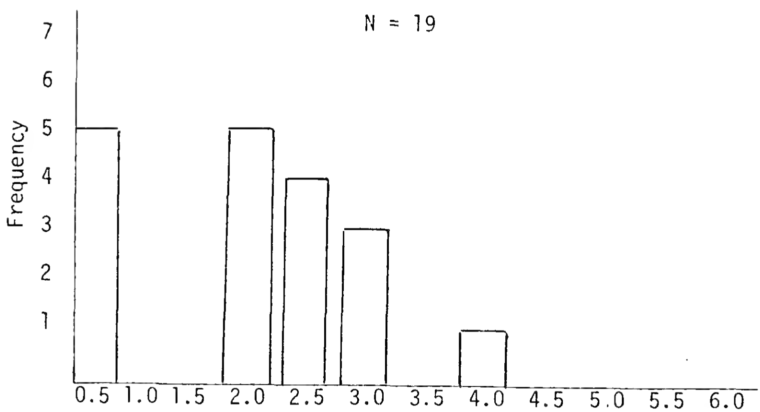
A Frequency Bar Graph of IQ Scores



PIAT Reading Recognition Grade Equivalent Scores

Figure 3

A Frequency Bar Graph of PIAT Reading Recognition Pretest Score Midpoints

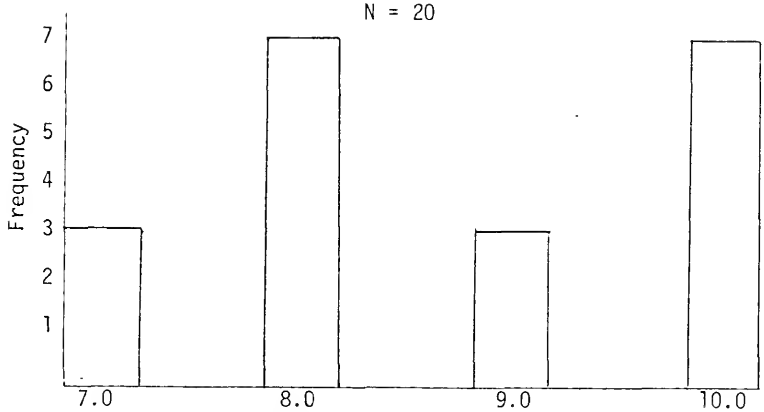


PIAT Reading Comprehension Grade Equivalent Scores

Figure 4

A Frequency Bar Graph of PIAT Reading Comprehension Pretest Score Midpoints

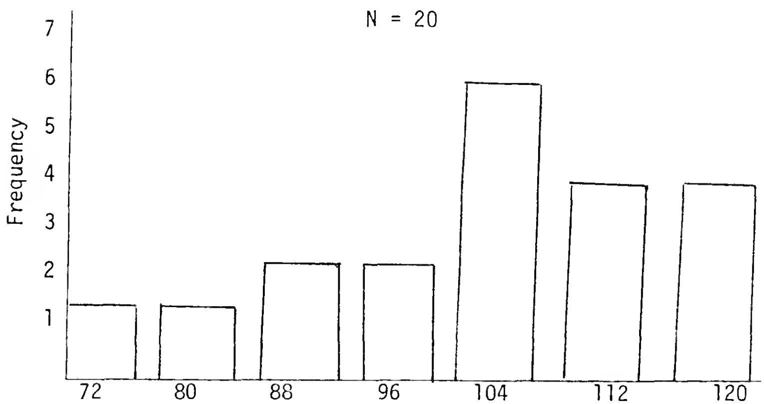
Characteristics of the LD Students in the VAKT Group



Chronological Age in Years

Figure 5

A Frequency Bar Graph of Chronological Age



IQ Scores

Figure 6

A Frequency Bar Graph of IQ Scores

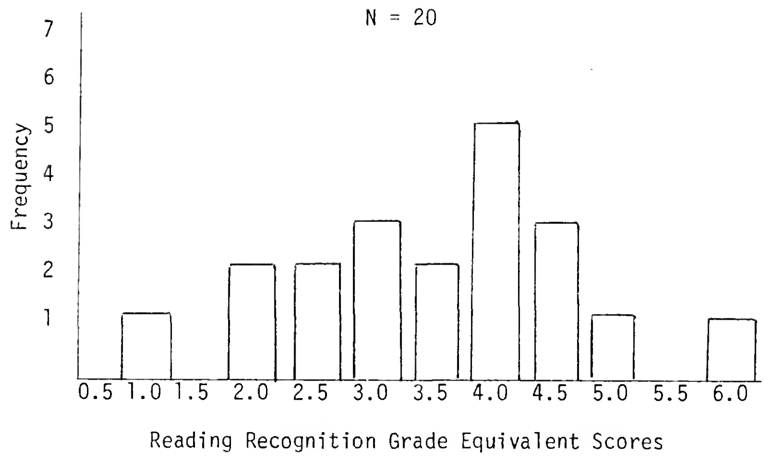


Figure 7

A Frequency Bar Graph of PIAT Reading, Recognition Pretest Scores

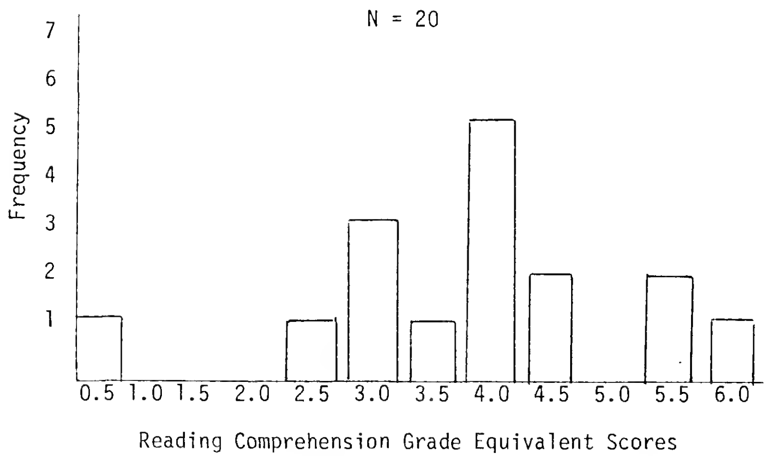
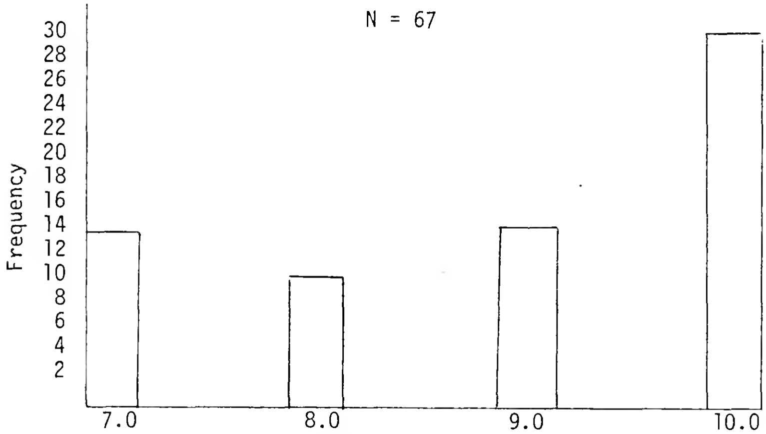


Figure 8

A Frequency Bar Graph of PIAT Reading Comprehension Pretest Scores

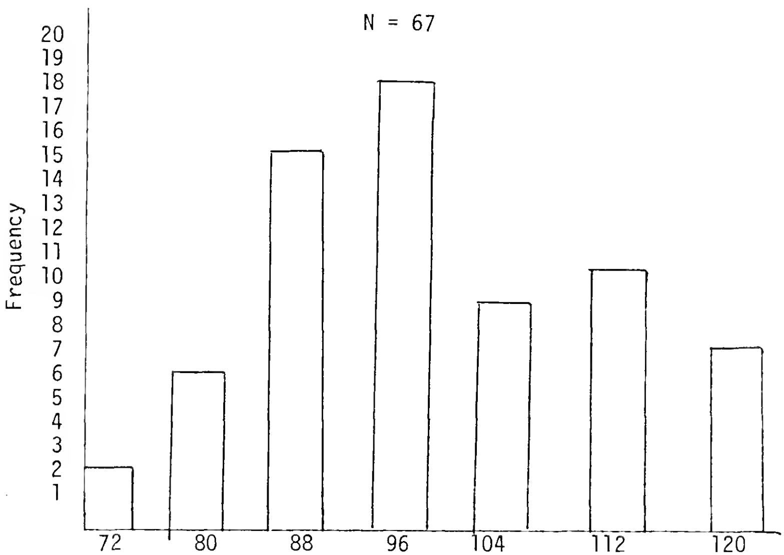
Characteristics of the LD Students in Section Two: WRAT/SIMS Group



Chronological Age in Years

Figure 9

A Frequency Bar Graph of Chronological Age



IQ Scores

Figure 10

A Frequency Bar Graph of IQ Scores

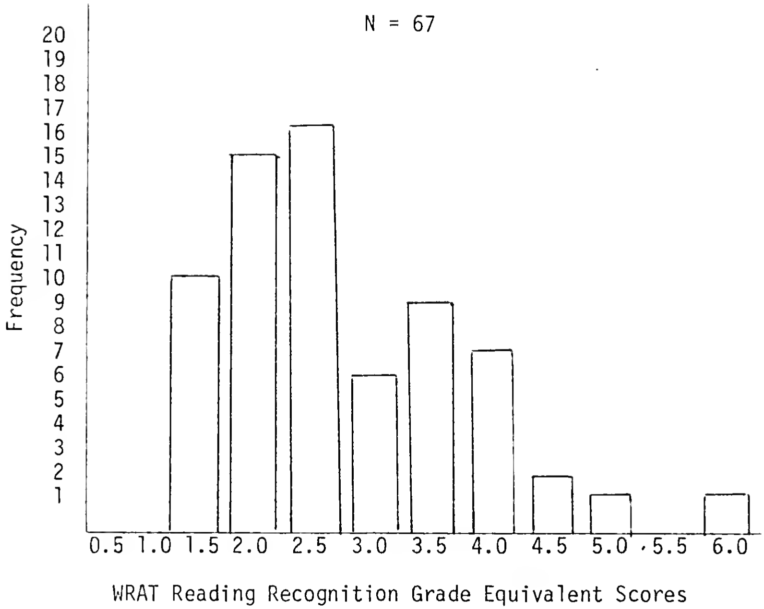


Figure 11

A Frequency Bar Graph of WRAT Reading
Pretest Score Midpoints

APPENDIX H

RAW DATA: SELECTIVE ATTENTION AND READING

Study One: Subject Code	Age At Pretest	IQ	Selective Attention C	I	%C-%I	Total	PIAT Pretest Grade Equivalent Rdg. Recog.	Rdg. Comp.	PIAT Posttest Grade Equivalent Rdg. Recog.	Rdg. Comp.
SIMS PROGRAM GROUP										
1	6.9		5	2	8	7	1.3	0.0	2.2	2.4
2	6.5		8	2	33	10	1.4	1.9	2.4	2.2
3	7.4		4	4	-33	8	1.0	0.0	1.8	2.7
4	10.3		6	2	17	8	1.8	2.8	2.2	2.8
5	8.2		8	1	50	9	0.9	0.0	1.8	2.0
6	10.3		5	4	-25	9	2.2	2.5	2.8	2.8
7	8.9		9	1	58	10	3.5	3.1	2.8	3.6
8	8.2		6	2	17	8	1.4	2.0	1.6	2.1
9	9.7		5	2	8	7	2.2	2.5	2.2	3.1
10	8.6		6	4	-16	10	1.5	2.2	2.6	2.6

APPENDIX H - Continued

Study One: Subject Code	Age At Pretest	Selective Attention IQ	C	I	%C-%I	Total	PIAT Pretest Grade Equivalent Rdg. Recog.	Rdg. Comp.	PIAT Posttest Grade Equivalent Rdg. Recog.	Rdg. Comp.
11	10.2	91	7	1	42	8	4.0	3.9	4.8	6.2
12	9.7	83	6	2	17	8	2.6	2.5	3.1	2.2
13	10.8	99	6	1	33	7	1.4	2.0	1.8	2.1
14	9.2	76	7	6	-42	13	2.0	2.9	3.8	3.3
15	9.3	102	10	1	67	11	1.8	2.5	3.5	3.4
16	8.6	83	5	0	42	5	1.4	0.0	1.5	2.0
17	8.2	106	6	1	33	7	1.1	-	2.8	-
18	9.0	97	8	6	-33	14	2.0	2.1	3.9	2.7
19	6.2	106	6	1	33	7	1.0	0.0	2.4	2.5
20	6.7	110	6	1	33	7	3.1	3.2	4.0	5.5

APPENDIX H - Continued

Study One: Subject Code	Age At Pretest	Selective Attention					PIAT Pretest Grade Equivalent		PIAT Posttest Grade Equivalent	
		IQ	C	I	%C-%I	Total	Rdg. Recog.	Rdg. Comp.	Rdg. Recog.	Rdg. Comp.
VAKT PROGRAM GROUP										
21	7.8	103	8	0	67	8	4.2	3.9	4.8	5.3
22	11.7	89	3	0	25	3	4.7	5.5	6.0	5.5
23	8.0	95	4	0	33	4	0.9	0.7	2.2	2.6
24	10.5	73	4	0	33	4	3.3	3.2	3.4	4.4
25	8.9	105	3	2	-8	5	2.6	3.9	3.0	3.3
26	9.6	107	12	4	99	16	3.0	4.1	4.5	3.9
27	7.8	87	4	1	17	5	3.9	3.9	5.0	2.8
28	7.1	122	7	4	8	11	2.0	3.1	3.3	3.8
29	8.2	121	10	4	17	14	4.8	6.5	5.6	12.8
30	8.3	126	11	3	42	14	4.0	4.5	4.2	4.5

APPENDIX H - Continued

Study One: Subject Code	Age At Pretest	Selective Attention IQ	C	I	%C-%I	Total	PIAT Pretest Grade Equivalent Rdg. Recog.	Rdg. Comp.	PIAT Posttest Grade Equivalent Rdg. Recog.	Rdg. Comp.
31	8.7	105	5	6	-58	11	3.0	3.6	4.1	4.5
32	7.5	83	6	3	0	9	2.0	2.7	3.0	4.5
33	10.6	110	8	2	33	10	3.3	4.5	3.9	7.5
34	8.5	116	10	3	33	13	4.1	5.3	5.2	6.0
35	7.9	123	5	3	0	9	2.4	3.9	3.9	4.1
36	10.7	109	6	6	-50	12	4.7	-	5.7	-
37	10.8	93	6	3	0	9	5.8	-	7.3	-
38	9.0	103	9	3	25	12	3.8	-	5.6	-
39	10.1	104	9	3	25	12	4.5	-	5.8	-
NON-LEARNING DISABLED GROUP'S BASAL READING PROGRAM										
40	9.8	122	11	0	92	11	5.7	7.6	7.0	10.2
41	8.7	113	7	1	42	8	6.2	4.7	6.4	5.3

APPENDIX H - Continued

Study One: Subject Code	Age At Pretest	IQ	Selective Attention C	I	%C-%I	Total	PIAT Pretest Grade Equivalent Rdg. Recog.	Rdg. Comp.	PIAT Posttest Grade Equivalent Rdg. Recog.	Rdg. Comp.
42	7.7	118	5	1	25	6	3.1	3.7	4.5	5.8
43	9.0	105	6	1	33	7	4.0	3.7	4.5	5.0
44	9.2	124	8	0	66	8	4.7	5.5	5.2	7.2
45	9.6	123	10	1	67	11	2.8	3.6	3.4	3.7
46	8.6	89	8	1	50	9	/	/	/	/
47	9.2	114	7	0	58	7	/	/	/	/
48	9.5	87	9	1	58	10	/	/	/	/
49	9.5	95	10	1	67	11	/	/	/	/
50	9.3	/	8	3	16	11	/	/	/	/

APPENDIX H - Continued

Study Two Subject Code	Age At Pretest	Selective Attention IQ	C	I	%C-%I	Total	WRAT Pretest Reading Recog. Grade Equiv.	WRAT Posttest Reading Recog. Grade Equiv.	Modality Preference Group
1	6.9	111	7	3	8	10	2.1	3.0	2
2	6.4	90	3	2	-8	5	1.8	2.2	2
3	6.7	89	6	3	0	9	1.3	2.4	2
12	7.3	122	8	3	17	11	1.6	4.0	1
13	8.0	101	7	4	-8	11	4.5	6.9	3
15	8.8	110	7	4	-8	11	4.0	5.5	2
21	9.5	93	8	3	16	11	2.7	2.8	3
27	7.4	108	7	0	58	7	3.5	4.4	2
29	6.3	105	5	3	-8	8	2.2	2.8	3
30	6.2	92	2	2	-17	4	2.1	2.5	3

APPENDIX H - Continued

Study Two Subject Code	Age At Pretest	IQ	Selective Attention C	I	%C-%I	Total	WRAT Pretest Reading Recog. Grade Equiv.	WRAT Posttest Reading Recog. Grade Equiv.	Modality Preference Group
31	7.3	97	3	0	25	3	2.2	2.5	3
36	6.9	99	7	4	-8	11	3.4	4.1	2
50	7.3	86	4	3	-17	7	2.3	4.0	2
60	7.2	117	10	4	17	14	1.5	3.2	2
4	8.3	92	2	1	0	3	2.2	3.6	2
9	7.5	125	5	0	42	5	1.5	4.0	3
10	7.5	114	8	6	-33	14	1.9	2.8	2
11	7.8	91	4	3	-17	7	1.5	2.5	3
13	8.0	101	7	4	-8	11	4.5	6.9	3
16	7.6	110	5	0	42	5	2.6	4.2	3

APPENDIX H - Continued

Study Two Subject Code	Age At Pretest	IQ	Selective Attention C	I	%C-%I	Total	WRAT Pretest Reading Recog. Grade Equiv.	WRAT Posttest Reading Recog. Grade Equiv.	Modality Preference Group
41	7.7	91	2	4	-50	6	1.5	2.1	3
45	8.3	85	6	0	50	6	1.5	2.2	3
56	7.7	87	3	1	8	4	1.9	2.1	3
62	7.7	115	9	1	58	2	2.4	3.8	2
65	8.3	112	7	4	-8	11	1.8	4.0	2
14	8.9	87	6	1	33	7	1.5	2.0	2
15	8.8	110	7	4	-8	11	4.0	5.5	2
17	8.8	87	5	2	8	7	1.6	2.0	3
18	8.8	126	6	1	33	7	4.4	5.3	1
32	9.2	86	6	2	17	8	2.2	3.6	2

APPENDIX H - Continued

Study Two Subject Code	Age At Pretest	IQ	Selective Attention C	I	%C-%I	Total	WRAT Pretest Reading Recog. Grade Equiv.	WRAT Posttest Reading Recog. Grade Equiv.	Modality Preference Group
33	9.4	109	10	3	33	13	3.2	4.2	2
34	9.3	117	4	0	33	4	2.6	3.0	3
35	8.7	73	7	6	-42	13	2.5	3.3	2
39	9.2	91	5	6	-58	11	3.0	3.8	2
42	8.7	109	11	2	58	13	2.5	3.4	3
43	8.5	100	3	2	-8	5	2.1	3.1	3
53	8.7	106	7	2	25	9	2.0	2.5	2
57	9.4	88	6	0	50	6	2.5	2.9	2
61	9.3	98	9	2	42	11	3.6	4.9	2
5	11.2	97	8	3	17	11	3.2	4.1	2

APPENDIX H - Continued

Study Two Subject Code	Age At Pretest	IQ	Selective Attention C	I	%C-%I	Total	WRAT Pretest Reading Recog. Grade Equiv.	WRAT Posttest Reading Recog. Grade Equiv.	Modality Preference Group
6	9.8	93	7	3	8	10	2.6	2.8	2
7	10.0	93	10	1	67	11	5.9	6.9	2
8	10.0	74	8	2	33	10	3.0	3.2	3
19	10.2	76	10	0	83	10	1.9	2.4	2
20	10.0	120	10	2	50	12	4.1	5.5	1
21	9.5	93	8	3	16	11	2.7	2.8	3
22	11.5	81	5	2	8	7	2.4	3.1	3
23	10.4	94	8	2	33	10	2.8	4.4	2
24	11.3	79	4	4	-33	8	5.0	7.2	2
25	10.0	106	11	4	25	15	3.3	4.5	2

APPENDIX H - Continued

Study Two Subject Code	Age At Pretest	IQ	Selective Attention C	I	%C-%I	Total	WRAT Pretest Reading Recog. Grade Equiv.	WRAT Posttest Reading Recog. Grade Equiv.	Modality Preference Group
26	11.3	101	8	2	33	10	3.3	3.2	3
28	10.8	85	7	2	25	9	2.6	2.9	2
37	9.9	85	4	1	17	5	3.3	3.8	2
38	11.0	92	10	4	17	14	4.0	4.7	2
40	9.8	92	7	2	25	9	2.5	2.9	2
44	10.2	92	8	6	-33	14	2.0	2.6	2
46	10.6	105	8	2	33	10	2.8	3.6	2
47	9.8	112	10	0	83	10	3.3	4.1	1
48	11.0	116	11	2	58	13	3.5	4.4	1
49	10.6	95	7	3	8	10	4.2	5.5	2

APPENDIX H - Continued

Study Two Subject Code	Age At Pretest	IQ	Selective Attention C	I	%C-%I	Total	WRAT Pretest Reading Recog. Grade Equiv.	WRAT Posttest Reading Recog. Grade Equiv.	Modality Preference Group
51	10.5	82	8	1	50	9	2.5	2.7	2
52	9.7	103	8	4	0	12	1.7	2.6	3
54	10.4	76	8	2	33	10	2.6	2.9	3
55	9.7	95	9	2	42	11	2.1	2.7	2
58	9.6	100	8	2	33	10	4.0	5.1	2
59	10.5	97	4	2	0	6	3.6	4.1	3
63	11.2	92	9	3	25	12	3.9	6.9	3
64	11.0	98	11	0	92	11	2.6	3.3	3
66	11.5	83	9	4	8	13	4.1	5.4	2
67	11.1	87	10	2	50	12	2.6	4.7	1

REFERENCE NOTES

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BIOGRAPHICAL SKETCH

Daniel Walker Becton was born at Murfreesboro, Tennessee, on December 28, 1947. He first showed interest in psychology as an illustrator for a research project in the Murfreesboro Public Schools with Dr. R. Klaus for George Peabody College in 1961. He graduated from Melbourne High School, Melbourne, Florida, in 1966. His science fair project in physiological psychology earned awards from the American Medical Association and the American Psychological Association at the International Science Fair and placed him in the honors group of the Westinghouse Science Talent Search.

He attended Vanderbilt University on a scholarship, majoring in psychology. Graduating in 1970, he was drafted. He then joined the U.S. Navy for four years, serving as a photographer. He also earned a teaching certificate in general science. He completed a Master of Arts degree in special education, K-12, all exceptionalities, with emphasis on the educational diagnostician program in 1975.

He returned to Florida to teach in the learning disability program in both elementary and secondary levels in Hillsborough County, Florida. He later completed certification in school psychology and began working with learning disabled adults at

Central Florida Community College in the Special Services Program in 1978. He has made numerous presentations on LD adults at the state level, some at the regional level (e.g. Southeastern Association of Equal Opportunity Program Personnel), and at the national level (e.g. Association for Children with Learning Disabilities National Convention, 1982 and 1983). His articles have been printed in Educational Resources Information Center (ERIC) System and the Journal of the Southeastern Association of Educational Opportunity Program Personnel.

Mr. Becton entered the doctoral program in foundations of education at the University of Florida in 1976. He will complete the requirements for the degree of Doctor of Philosophy in December, 1982. He will continue as coordinator for handicapped students and school psychologist for the Special Services Program at Central Florida Community College, which includes serving the Alyce D. McPherson School.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Dr. Robert E. Jester, Chairperson
Associate Professor of Foundations of Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Dr. Donald L. Avila
Professor of Foundations of Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Dr. William D. Wolking
Professor of Special Education

This dissertation was submitted to the Graduate Faculty of the Department of Foundations of Education in the College of Education and to the Graduate Council, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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Chairman, Foundations of Education

Dean for Graduate Studies and Research